IDENTIFYING FACTORS ASSOCIATED WITH PHYSICAL THERAPISTS' ADHERENCE TO LOW BACK PAIN GUIDELINES ACROSS THE DOMAINS OF THE CONSOLIDATED FRAMEWORK FOR IMPLEMENTATION RESEARCH: A MIXED METHODS STUDY

by

Joel M. Stevans

Bachelor of Science, Biochemistry, California Polytechnic State University, SLO, 1996

Doctor of Chiropractic, Los Angeles College of Chiropractic, 1994

Submitted to the Graduate Faculty of

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SCHOOL OF HEALTH AND REHABILITATION SCIENCES

This dissertation was presented

by

Joel M. Stevans

It was defended on

August 10, 2016

and approved by

Kelley Fitzgerald, PT, PhD, FAPTA, Professor, Department of Physical Therapy, Associate Dean of Graduate Studies, School of Health and Rehabilitation Sciences

Michael J. Schneider, PhD, DC, Associate Professor, Department of Physical Therapy, Associate Professor, Clinical and Translational Science Institute

Jennifer S. Brach, PhD, PT, Associate Professor, Department of Physical Therapy, Associate Professor, Clinical and Translational Science Institute

Lauren Terhorst, PhD, Associate Professor, Department of Occupational Therapy, Associate Professor, Clinical Translational Science Institute

Laurita M. Hack, PT, DPT, MBA, PhD, FAPTA, Professor Emeritus, Department of Physical Therapy, Temple University

Dissertation Advisor: Anthony Delitto PhD, PT, FAPTA, Professor, Department of Physical Therapy, Dean, School of Health and Rehabilitation Sciences

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In 2007 a regional physical therapy (PT) organization implemented low back pain (LBP) guidelines throughout its 50 outpatient clinical sites. Despite multiple improvement efforts since that time guideline adherence is suboptimal (38%). In this study the Consolidated Framework for Implementation Research (CFIR) guided an evaluation to identify determinants of adherence.

A sequential, mixed methods design was used to identify determinants of adherence to LBP guidelines. We surveyed PTs using instruments pertinent to LBP management and implementation success to explore factors associated with guideline adherence across three CFIR domains: Individual, Innovation, and Inner Setting. Instruments included the Pain Attitudes and Beliefs Scale, Intolerance of Uncertainty Scale, Ottawa Acceptability of Decision Rules Instrument, and Alberta Context Tool. Survey responses, provider demographics and professional characteristics were merged with risk-adjusted measures of guideline adherence using data from the organization's database. Generalized linear models (GLM) were first used to assess univariate associations, then main effects and 2x2 interactions were evaluated using GLM with forced, backward stepwise elimination. The sample was stratified by quartile using the risk-adjusted adherence measure. Purposive maximum variation sampling identified 15 high and 15 low performing providers for semi-structured telephonic interviews.

One hundred and twelve survey completers (74%) had a risk-adjusted guideline adherence measure and were included in the study. There was no association between PT's acceptability of individual guideline recommendations and adherence. There were significant interactions between Professional Certification (PC) and Uncertainty Paralysis (β=-0.06, p>0.05), PC and Time to Deliver Quality Care (β=0.26, p=0.03), and PC and Connections with Colleagues (β=0.36, p=0.01). Qualitative interviews identified barriers to adherence resulting from the complexity of the guidelines and limited skills required to carry out some of the recommendations. The interviews also revealed that perceived support for the initiative was stronger from senior management compared to front line supervisors.

This study addresses three gaps in the dissemination and implementation literature: 1) it describes one method to identify determinants for tailoring interventions; 2) it quantifies interaction effects within and between CFIR domains; and 3) it assesses determinants of sustainability in a mature implementation initiative.

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PREFACE

To Kathleen and Victoria:

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1.0 THE SPECIFIC AIMS OF THE PROPOSED STUDY

The quality of care within the United States' (US) healthcare system is suboptimal.[1] A significant deterrent to high quality care is the failure of clinicians and healthcare organizations to systemically implement, and consistently use, the best available scientific evidence when treating of patients. A perfect example of this failure to routinely use research evidence can be appreciated in the management of low back pain (LBP). LBP is the most common cause of pain in the US resulting in substantial morbidity, disability, and cost in the US.[2-7] Because of the enormous burden of this condition numerous evidence-based clinical practice guidelines have been produced in an effort to improve the quality of LBP management.[8-11] Despite almost 20 years of LBP guideline dissemination, the failure of clinicians to routinely use this information remains an impediment to high quality healthcare.[12-15]

Emerging evidence suggests that the adoption and sustained use of research evidence, such as LBP guidelines, is improved when implementation interventions are customized to account for the unique circumstances of a practice setting and tailored to address specific barriers preventing their use.[16] Barriers to using research evidence may be external to the organization, can result from within the organization, and may pertain to the individuals that must adopt new behaviors or may be related to the nature of the research evidence itself.[17,18] Further complicating the situation is the potential for interplay between factors at two or more levels within the healthcare setting.[17,18] Because research utilization may be impeded by the interaction

or interdependencies between numerous factors at differing levels, barrier identification and an intervention prescription should be conducted using a "systems" perspective.[19] Systems-thinking explicitly focuses on the interaction and mutual dependencies of the various factors at play both within and between levels.[19] However, very little is known about the nature of these interactions, how they combine to deter the use of best available evidence, and what types of interventions will overcome these barriers to improve research utilization in everyday practice.

The overall goals of this study are to perform a systems-level diagnostic evaluation and develop an intervention prescription to improve evidence based LBP management within a large physical therapy organization. Our work will be guided by the Consolidated Framework for Implementation Research (CFIR) which is a meta-theoretical framework that explores five key domains ideally suited to multilevel systems evaluations.[20] The use of the CFIR will focus information gathering and mitigate the risk of overlooking theoretically important system components. The specific aims of the study are:

Specific Aim #1: Identify determinants of variation in adherence with evidence-based LBP treatment guidelines. Cross sectional administrative data will be used to develop risk-adjusted LBP performance profiles for individual physical therapy providers. The risk-adjusted profiles will allow more equitable comparisons between providers by controlling for the confounding effects of differences in patient-mix. The physical therapy providers will be surveyed using an array of validated instruments. Organizational (e.g., leadership, culture) and process related (e.g., resources) factors will be investigated with the Alberta Context Tool. The LBP guidelines will be assessed using the Ottawa Acceptability of Decision Rules Instrument. Physical therapists' LBP attitudes and beliefs will be investigated using the Pain Attitudes and Beliefs Scale for Physical Therapists. Dispositional personality traits will be assessed with the

Core Self Evaluations (e.g., self-efficacy, self-esteem) instrument, the Resistance to Change Scale and the Intolerance for Uncertainty Scale.

A range of organizational (clinic) and therapist level demographic and professional characteristics will also be obtained. These data will be used to quantify significant factors associated with variation in LBP guideline compliance.

Hypothesis #1: Organizational characteristics will be associated with variation in LBP guideline compliance.

Hypothesis #2: Acceptability of LBP guidelines will not be associated with variation in LBP guideline compliance.

Hypothesis #3: Personal attributes of physical therapists will be associated with variation in LBP guideline compliance.

Hypothesis #4: Interaction effects between organizational characteristics, acceptability of LBP guidelines and the personal attributes of physical therapists will be associated with variation in LBP guideline compliance.

Specific Aim # 2: Conduct semi-structured interviews with physical therapists to ascertain barriers and facilitators to compliance with the evidence-based LBP guidelines. The CFIR domains, along with findings from our quantitative investigation in Aim #1, will be used to inform the development of an interview guide to be used during telephonic interviews with the University of Pittsburgh Medical Center (UMPC) Centers for Rehab Services' (CRS) physical therapists. During these interviews we will thoroughly explore possible determinants and perceived barriers to compliance with the LBP guidelines. A thematic analysis will be conducted to catalogue and determine barriers to the use of the LBP research evidence.

We expect the findings from our theory informed investigation of barriers to LBP treatment to not only yield valuable information for our partner organization (CRS), but to also produce information that will be of considerable benefit to the physical therapy profession and the broader field of implementation science.

1.1 RESEARCH STRATEGY

1.1.1 Background and Significance

"Quality problems are everywhere, affecting many patients. Between the health care we have and the care we could have lies not just a gap, but a chasm." [21]

This sobering quote exemplifies the principal finding from the Institute of Medicine's (IOM) report – Crossing the Quality Chasm: A New Health System for the 21st Century.[21] According to the report there is widespread underuse of effective healthcare services in the US, while at the same time patients are routinely subjected to overutilization of ineffective services, and are often put in harm's way by serious medical errors.[21,22] This "overuse, underuse, and misuse" of healthcare services defines the quality problem in the US by underscoring the pervasive existence of unwarranted clinical variability.[21]

In their report, the IOM articulated a vision for transforming the US healthcare system with the goal of closing the "chasm" between evidence-based, quality healthcare and the highly variable care patients experience every day.[21] The IOM made a special emphasis to note that this undertaking would not be easy, reinforcing the fact that delivery of high quality healthcare is beset by a myriad of barriers.[21] Ten years have passed since the IOM issued their

recommendations and this warning has proved prophetic. In spite of a decade of efforts to improve the quality of care in the US, the 2011 National Healthcare Quality report concluded ***"the gap between best possible care and that which is routinely delivered remains substantial across the Nation".***[23]

1.1.1.1 Accelerating the Routine Clinical Use of Research Evidence

Given the unjustifiable gaps in healthcare quality there has been a major shift in the existing research paradigm. This new paradigm has been specifically designed to improve the quality of care in the US by accelerating the application of research findings from the laboratory into routine clinical practice.[21,24] The new paradigm, termed Translational Science, has three distinct phases. This research paradigm posits that at each translational phase specific strategies are needed to accelerate the progress of research from laboratory studies to the routine use in clinical practice.[24]

The first translational phase (T1) is designed to advance evidence from basic science discoveries to knowledge about clinical efficacy.[24] To bridge this gap laboratory scientists are required to justify their bench research in light of its potential clinical application with the goal of quickly moving promising developments to controlled efficacy studies. In turn knowledge gained from clinical efficacy studies is then used to inform clinical effectiveness knowledge–the second translational phase (T2).[24] Two of the most common translational strategies utilized to span from efficacy to effectiveness knowledge are comparative effectiveness and outcomes research.[24]

The final translational phase (T3) takes knowledge gained by testing interventions in pragmatic settings (i.e., effectiveness trials) and seeks to propagate the use of evidence based

interventions in routine clinical practice where the benefits will result in improved healthcare quality.[24] Strategies designed to facilitate progress through T3 focus on identifying mechanisms that foster the reliable delivery of high quality care. Unfortunately, the results of research in this area have been highly variable and mostly disappointing.[25] ***The disappointing results may be due to the underuse of theoretically sound interventions or it may reflect a failure to employ systematic methodology when designing an intervention.[26] As one researcher has put it "…some [interventions] work some of the time, none work all of the time, and more research is needed to figure out what works where and why."[20]***

1.1.1.2 The Failure to Use Research Evidence Is Not a New Problem

The failure of healthcare providers and organizations to translate research evidence into the routine care of patients, the third translational phase, is a vexing barrier to high quality care. (IOM) This research utilization or knowledge translation problem is not new but has been a recognized barrier to the best care of patients for over 35 years.[27] As a case in point, in 1975 the National Diabetes Commission published an extensive review of the state of diabetes care in the US. In this report they contend the fundamental flaw in diabetes care was the inability to "translate" the accumulated scientific evidence and uniformly apply what was known in the treatment of diabetic patients who might benefit.[27]

The pathway between production of research evidence and its use in everyday practice is long and torturous. It is estimated that up to 20 years are needed for 14% of research evidence to ultimately be translated into to the care of patients.[28] Some research suggests that up to 50%–70% of patients do not receive evidence based care during their clinical encounters.[21,22,29,30] Even more troubling, 20%–30% of people may receive contraindicated treatments that are more likely

to harm than help them.[21,22,29,30] As a result, identifying and rigorously evaluating mechanisms that speed the utilization of research in routine healthcare encounters has become a major emphasis in the US and abroad.[21]

1.1.1.3 Phase 3 Translation – "The Tower of Babel"

One issue that makes the discussion and study of Phase 3 activities particularly challenging is a lack of standardized terminology in the field. McKibbon has referred to this as the "Tower of Babel."[31] The terminology used to describe Phase 3 efforts varies between counties, between healthcare systems, and even within individual organizations. Terms commonly used for these activities include, but are not limited to, quality assurance, quality improvement, research utilization, knowledge translation, innovation diffusion, and implementation research. [31,32] A quote attributed to Avedis Donabedian, an early pioneer in this field, illustrates this issue well: "we have used these words in so many different ways that we no longer clearly understand each other when we say them".[17]

To avoid this confusion the following operational definitions for specific Phase 3 activities will be used within the confines of this project:

- Conceptual Research Utilization – The use of research findings to change thinking or opinions, but not necessarily actions, about how to approach patient care.[33,34]
- Instrumental Research Utilization – The direct use of research findings in planning and delivering patient care.[33,34]
- Clinical Innovation – Evidence based clinical program or strategy introduced into a health care setting that is designed to create routine instrumental research utilization.[35]

- Adoption – the decision of any individual or organization to make use of a clinical innovation.[36]

- Implementation – the gateway between a decision to adopt a clinical innovation and the sustained use of that innovation; the transition period during which targeted stakeholders become increasingly skillful, consistent, and committed in their use of a clinical innovation.[37]

- Dissemination – effort to communicate information to target audiences with the goal of adoption and implementation of a clinical innovation. Dissemination is integral to, and not separate from, implementation.[38]

- Implementation Intervention – a single method or technique to facilitate change and thereby adoption and committed use of a clinical innovation (e.g., an opinion leader, electronic clinical reminder, or interactive education program).[38]

- Implementation Strategy – an integrated set (bundle, package) of implementation interventions.[38]

- Implementation Research – the scientific study of methods to promote the systematic adoption and committed use of clinical innovations in routine practice, and, hence, to improve the quality and effectiveness of health services and care. This includes the study of influences on healthcare professional and organizational behavior.[38]

- Quality Improvement / Quality Assurance Initiative – a program focused primarily on improving patient care within a given patient care environment (e.g., hospital or health care organization). As such, the outcome of the project may not be generalizable to other patient care environments.[39]

1.1.1.4 Single Interventions Are Only Marginally Effective

Interest in the study of implementation interventions to close the evidence to practice gap has grown considerably over the last decade. [25] Two factors driving this keen level of interest are: 1) the well-documented quality of care gaps; and 2) the realization that passive diffusion of research evidence (e.g., peer reviewed journals) and traditional professional development techniques do not effectively change provider behavior or produce optimal care.[17,40] These insights have led to the proliferation of research evaluating the effectiveness of implementation interventions designed to create professional behavior change.

Recently, the Cochrane Effective Practice and Organization of Care (EPOC) review group has published a series of systematic reviews to evaluate the effectiveness of a number of implementation interventions directed at professional behavior change. When these reviews are considered in aggregate the results uniformly reveal small but significant improvements in professional practice. The interventions considered by EPOC, along with the median absolute improvement (risk difference) in professional behavior for each are as follows: audit and feedback (RD = 4.3%), educational meetings (RD = 6.0%), educational detailing (RD = 6.0%), computerized reminders (RD = 4.2%), local opinion leaders (RD = 12.0%), and published clinical guidelines (RD = 4.3%). [41-46] As can be appreciated, the median effect sizes are remarkably similar.[17,41-46]

Given the homogeneity and magnitude of the effect sizes, it may be reasonable to conclude that the observed improvements were manifest simply by intervening and that the particular implementation strategy was unimportant.[17] However, this may be a faulty conclusion. As Grimshaw, et.al. point out the interquartile range (IQR) across the group of interventions varies by a wide margin (30%). Furthermore, there are also wide within intervention IQRs that

can range up to 18%.[41-46] Two interventions with particularly wide IQRs are computerized reminders (0.8% to 18.8%) and educational meetings (1.8% to 15.3%).[43,44] The wide variation observed in outcomes may have important implications when choosing an intervention because some interventions may be better suited for specific behaviors. For example, educational meetings do not appear to be effective for complex behaviors (RD = -0.3%).[43] This intervention, however, may be appropriate in other circumstances. The wide range in effect sizes, both between and within interventions, appears to indicate that certain behaviors respond more favorably when the implementation intervention is tailored to address specific barriers preventing the desired behavior.[17,26]

1.1.1.5 Tailored Interventions More Effectively Change Behavior

Tailored interventions are defined by EPOC as implementation interventions that have been planned following a prospective assessment to identify determinants of clinical variation or specific barriers to behavior change.[47] A recent EPOC systematic review included 26 studies which compared tailored interventions to non-tailored (i.e., clinical guidelines) or no intervention.[47] Twelve of these studies provided adequate data for a meta-regression analysis.[47] The results of the pooled analysis showed that the odds of professional behavior change are 1.54 (95% CI, 1.16 to 2.01) times higher for tailored interventions when compared to non-tailored or no interventions.[47] The authors conclude that prospective identification of barriers and the tailoring of implementation interventions are more likely to improve professional practice than the dissemination of guidelines or the status quo.[47]

These findings support the empirical findings that have been reported from the field. For example, an outgrowth of the work that has been conducted in response to the 1975 report on the state of diabetes care by National Diabetes Commission has led to the appreciation that:

> "The implementation [translational] strategy appropriate for negotiating a particular barrier depends upon the nature of the barrier and the unique influence that it may have on the adoption of a particular element of new science. Barriers are not universal in their effect on all science, nor are they universal in their ability to impair adoption by all potential recipients. The role of implementation [translational] research is to analyze the kinds of barriers, the influence they have in particular situations, and the development of specific strategies to deal with these situations."[27]

Despite the importance of identifying barriers prospectively the best methods to accomplish this task are poorly understood and require further development. [47]

1.1.1.6 Barriers to Research Utilization Exist On Many Levels

Healthcare organizations, both large and small, are complex systems operating within the larger landscape of healthcare delivery in the US. In essence the delivery of healthcare in the nation can be thought of in a hierarchical structure with environmental factors (e.g., reimbursement, regulatory policies) comprising the top level.[18] Under this environmental umbrella there are additional levels of the hierarchy that become increasingly granular: organizations, sites/units, and individuals.[18] Further, complicating the situation is the fact that there are inter-dependencies that exist between different levels within the hierarchy, as well as intra-dependencies within a

level. Given the complexity of the healthcare system it is not surprising that barriers to research utilization can exist on all levels.

Multiple studies have reported barriers to research utilization at each level of the hierarchy. Examples, of environmental barriers to research utilization include financial disincentives, regional standards of practice, and poor interprofessional cooperation.[17,18,48-55] Similarly, poor leadership, lack of resources, frequent mergers, administrative constraints, and cultural climate has been identified as organizational barriers to research utilization.[17,18,48,49,51-55] Site or unit levels barriers include team cooperation, nebulous professional roles, lack of authority to affect change, and poor communication.[18,48,50,54] Finally, there has been extensive research showing that individual knowledge, attitudes, skills, and personality traits can all act as barriers to research utilization.[17,18,47-56]

The barriers articulated here reflect only a subset of all known barriers to research utilization. Further clouding the picture is the fact that the dynamics at play, or the specific barriers influencing research utilization for one system, organization, unit or individual can be very different than barriers in another. The complexity of this issue highlights the need to eschew one size fits all approaches and carefully evaluate the context of each healthcare setting to tailor an appropriate intervention. [57]

1.1.1.7 The Importance of Context

Within the purview of implementation research the term “context” is used to refer to the environment or setting in which the clinical innovation is being implemented.[58,59] More specifically, it can be thought of as the characteristics of the social system within an organization or its environment that influence research utilization.[60-62] Contextual factors are external or

internal variables that impose constraints, provide incentives, or shape the behaviors of organizational members.[39] Many organizations fail to fully gain employee's skilled, consistent and committed use of a clinical innovation, which is more likely to create cynicism than performance improvement.[62,63] Successful implementation often requires sustained leadership, ongoing support, realigned incentives, and cultural receptivity to change.[39] ***Importantly, research has begun to reveal that implementation failures are often explained by contextual factors.*** [50,61,64] ***For this reason contextual factors should not be viewed simply as scenery in the background but instead as collection of variables that mutually interact with other system parts to impact research utilization.***[61,62,64,65]

1.1.1.8 Systems Thinking Needed for Multidimensional Interventions

To gain an appreciation of how the complex interchange between contextual factors and individuals that comprise an organization produces the observed behaviors requires "systems-thinking".[19] Systems-thinking is different from traditional analytic methods and will often produce very different conclusions.[19] Traditional analyses seek to isolate and study individual elements of broader phenomena to identify "lower level causes" for the observed outcomes.[19] Conversely, systems-thinking focuses on the global picture to investigate the interaction and mutual dependencies between different elements in the system and understand how these relationships produce the observed outcomes.[19,39] The goal is to create actionable systems solutions that account for the interrelationships between numerous elements that are inherent in dynamic and complex settings.[19]

Implementation of a new clinical innovation is challenging for both individuals and organizations.[39] Barriers to the sustained and committed use of a clinical innovation occur at

both the individual and organizational levels. ***Despite the existence of barriers at multiple levels within an implementation context, many interventions target change at a single level which ignores the interdependencies and impact that each level exerts on the other.[18] There is a growing consensus that improving research utilization and healthcare quality requires multidimensional strategies that take into account these relationships.[17,52,55,61,64] However, the dynamic interplay between individuals and their organization and ways in which these interactions influence research utilization remain poorly understood.***

1.1.1.9 Theory Informed Evaluation and Intervention Design

A recent systematic review of 235 rigorously conducted investigations reporting on implementation interventions found that only 22.5% reported the use of a theoretical framework to inform their choice and design of the intervention. [66] As stated previously, the effectiveness of implementation interventions has been limited and the outcomes can vary considerably both within and across interventions. [26] The observed variability in outcomes for studies that purport to use the same intervention may be due in part to important differences in context, barriers, or the presence of effect modifiers that were unrecognized or not reported.[17,26] However, understanding these important differences is difficult because so few studies use or describe the theoretical rationale for their intervention.[67] ***The use of theory in implementation research can improve this situation by testing individual or organizational behavior change interventions that target specific barriers or contextual factors.[68] This will permit the active ingredients of an intervention to be identified, provide insight into factors that mediate or moderate the outcome, and facilitate generalization across different contextual settings.[68] For these reasons there is an urgent need to conduct theoretically informed research to investigate barriers to***

research utilization, designing interventions, and explore multi-level interactions in an effort to advance the science of implementation research.[61,66]

1.1.1.10 Consolidated Framework for Implementation Research

Given the pressing need to conduct theoretically informed research our work will be guided by the Consolidated Framework for Implementation Research (CFIR). The CFIR is a meta-theoretical framework which accounts for the complexity of healthcare settings and the multi-level nature of factors that can affect implementation. This makes it a robust framework for system-level evaluations.[69] Many theories pertinent to research utilization exist in the literature. For example, theoretical models for dissemination, innovation adoption, individual and organizational behavior change, and research utilization theories are all potentially applicable to implementation research per se.[65,70] While there is considerable overlap between the various theories, critical review of these models shows that these diverse theories are typically missing key domains important for implementation research.[65] The CFIR rectifies this issue by merging 19 conceptual models into a single framework that captures the contributions of each model and identifies a comprehensive set of domains believed to influence research utilization.[65]

The CFIR defines five domains and 40 mutable constructs that are all potential targets for tailored implementation strategies. [69] The domains and constructs include:

1) Outer setting (e.g., patient needs, peer pressure, external policies & incentives);
2) Inner setting (e.g., leadership, culture, networks & communication, goals & feedback);
3) Characteristics of individuals (e.g., knowledge & beliefs, personal attributes);
4) Characteristics of the clinical innovation (e.g., evidentiary strength, complexity); and

5) Implementation process (e.g., planning, opinion leaders, champions)

The use of CFIR in the current study will mitigate the risk of overlooking theoretically important components during the diagnostic evaluation while at the same time focusing our information gathering and research efforts. To date the CFIR has been used during active implementations to guide formative evaluations and it has been used retrospectively for literature reviews.[65,69,70] ***To our knowledge we will be one of the first to use this framework to guide prospective barrier identification.***

1.1.1.11 Quality Improvement Methodology

In addition to the use of theoretical frameworks to guide barrier identification and intervention development, systematic methods for the conduct of implementation research should also be used.[71] In this study we will employ the model put forth by the US Department of Veterans Affairs (VA) as part of their Quality Enhancement Research Initiative (QUERI). The goal of QUERI is to improve healthcare quality within the VA while simultaneously contributing to the evolution of implementation science. An important outgrowth of their considerable efforts over the last 15 years has been the development and refinement of a core set of steps for closing gaps in clinical quality. The QUERI six-step model provides a complete road map to guide the entire quality improvement journey. The six steps are: 1) select conditions associated with high risk of disease and/or disability and/or burden of illness; 2) identify evidence-based guidelines, recommendations and best practices; 3) measure and diagnose quality and performance gaps; 4) implement improvement programs; 5) document the effect of the program on the use of evidence-based practices; and 6) document the effect of the program on health-related quality of life.

In this study we are specifically interested in Step 3, which provides methodological guidance specific to the measurement and diagnosis of quality and performance gaps. According to the QUERI model Step 3 involves three distinct phases (A-C):

- 3A – Measure existing practice patterns and outcomes to identify variations from evidence-based practices;
- 3B – Determine current practices, as well as barriers and facilitators to improving practice; and
- 3C – Diagnosis quality gaps and identify barriers and facilitators to improvement.

Phase 3A requires healthcare organizations to dig deeply into the behavior of their own environment to understand existing practice patterns and identify variation in research utilization.[19] During this phase it is also important to begin to identify factors that may be responsible for observed quality gaps. Investigative methods used during this phase include field observation, process and task modeling, surveys, and cross-sectional studies.[19,48] The identification of performance gaps is necessary but often is insufficient to institute meaningful change. Like medical signs and symptoms, performance gaps indicate problems exist, but they do not provide a definitive diagnosis.

Phase 3B provides a deeper assessment of determinants that are driving variation in research utilization. One goal in this phase is to identify individual and contextual factors that are preventing the desired behaviors.[19,71] Another goal is to uncover factors that facilitate and support the desired behavior.[19,71] Knowledge of both barriers and facilitators is necessary to most effectively diagnosis the "low hanging fruit" and tailor an intervention appropriately.[19,71] Investigative methods characteristic of this phase include surveys, semi-structured interviews, and focus groups with key personnel.[19,48]

Phase 3C synthesizes the data collected in the first two phases to diagnosis the "mission critical" causes for the quality gaps and determine the most actionable remedies for these problems. [17,19,71] ***Many barriers and facilitators to research utilization are typically identified and it is unrealistic to try to address them all.[19,71,72] Therefore, the primary challenge is astutely analyzing the information on hand to identify mutable barriers to behavior change and correctly target the most important individual or contextual factors with theoretically sound interventions.[17,57]*** Intervention mapping is an established technique used to facilitate this process.[19,71,73] The technique is used to specifically define desired behavior, articulate barriers preventing the desired behavior, and match and prioritize theoretically informed interventions to maximize the likelihood of success**.**[19,71,73]

1.1.1.12 Low Back Pain – A Costly and Persistent Quality Problem

Low back pain (LBP) is the most common cause of pain in the US resulting in substantial morbidity, disability, and cost.[2-7,74] Direct health care costs for treatment of LBP are estimated to exceed $50 billion annually, and the indirect costs (e.g., productivity) associated with this condition are even greater.[2,4] The estimated lifetime prevalence ranges from of 60%-85% and approximately 25% of US adults report experiencing an episode of LBP during the previous 3 months.[6] While the prognosis is generally considered good, recurrences are common (20%-35%) and 5%-20% of patients will go on to develop chronic pain.[75-77]

Despite its high prevalence and considerable economic impact, LBP remains a vexing management challenge. Over the past 20 years various evidence-based clinical practice guidelines for the management of LBP have been disseminated with the goal of increasing the effectiveness and efficiency of care.[8,10] Despite these efforts guideline adherence is notoriously

low among healthcare professionals, including physical therapists.[12,13,15,78] This has led to well documented clinical variation and quality of care gaps.[4,12,78,79] When low back pain is viewed in light of QUERI Steps 1 and 2, it is clear that the substantial societal burden of low back pain, coupled with the extensive library of evidence-based clinical practice guidelines, makes it an excellent quality improvement target.

1.1.1.13 Real World Implementation Challenges

The Centers for Rehab Services (CRS) is a wholly owned subsidiary of the UPMC Health System with 50 outpatient physical therapy sites throughout Western Pennsylvania. The CRS employs more than 170 full- and part-time physical therapists and provides treatment to more than 4,500 LBP patients annually. In 2007 the CRS' executive leadership recognized the need to standardize care within their organization in an effort to reduce unwarranted clinical variability and improve outcomes for patients with low back pain. As a result a system-wide quality improvement initiative was launched to disseminate and implement evidence-based LBP guidelines throughout their facilities. For the last nine years the organization has made concerted efforts to engender compliance with the guidelines without satisfactory success. ***We will partner with the CRS to perform a systems-level diagnostic evaluation and develop an intervention prescription within the context of the low back pain quality improvement initiative.***

1.1.1.14 Building the Theoretical Framework within the Study Context

Many factors can potentially affect research utilization. According to the CFIR these factors fall into five domains and 40 broad constructs.[65] We have used this framework to develop a theoretical model specific to the pertinent contextual factors associated with the CRS' low back pain quality improvement initiative. Through our literature review and preliminary work

(Section 1.3.1.4) with the organization we have identified 12 constructs across the five CFIR domains that are likely to be associated research utilization within this context. (Figure 1) Our mixed method study will allow us to explore the influence related to each of the constructs of interest. Some constructs will be explored using both quantitative and qualitative methods and some will only be explored qualitatively. For a construct to be included in the quantitative analysis (Aim #1) three criteria had to be met: 1) reliable measures for the construct were available; 2) construct validity evidence existed for interpretation of the measure's score; and 3) the measure had been successfully used in previous research on organizational behavior change, content evaluations of clinical innovations, or the management of low back pain.[80]

In our model we have included two constructs from the outer setting: reimbursement and competitive pressure. Reimbursement mechanisms, such as fee-for-service, pay-for-performance, and episode-based payments are generally imposed on clinicians by public and private third party payers. These reimbursement methodologies can have both positive and negative influences on research utilization.[39,81] Clinicians cite lack of reimbursement as a barrier preventing research utilization while other studies have shown alternative methodologies (e.g., episode payments) can have a positive influence.[49,81,82] Competitive pressure refers to the influence exerted by any outside entity, at any level within the organization (e.g., executive), where there is a perceived or real need to create a discernible market advantage.[65] Competitive pressure has been found to have a strong positive association with the implementation of clinical innovations.[39]

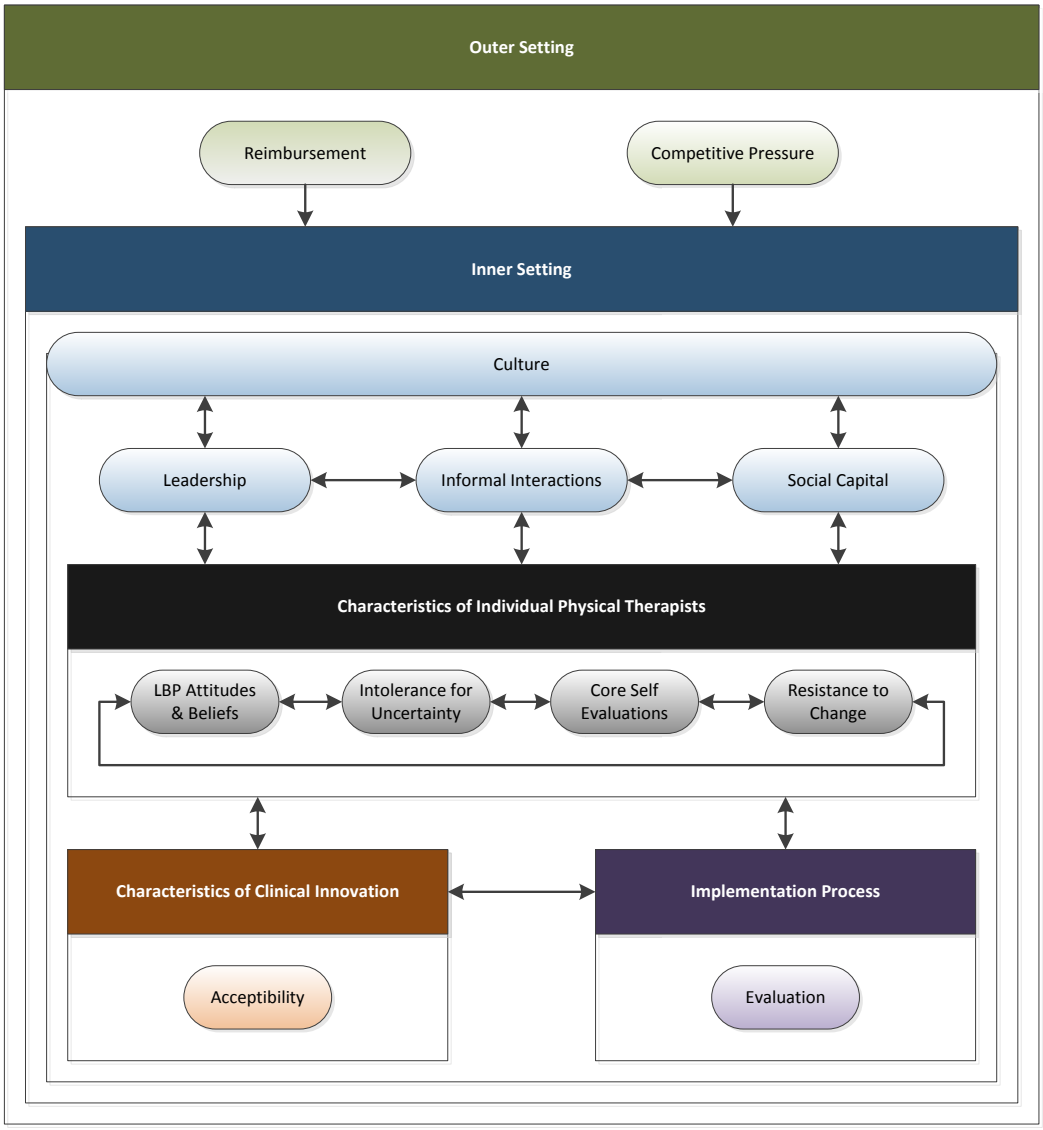


Figure 1. Theoretical Framework Guiding the Study

There are four constructs within the inner setting that will be explored in this study: culture, leadership, informal interactions, and social capital. Culture is defined as the norms, values and basic assumptions which give the organization a "character and feel."[65,83] Culture is believed to be a stable, socially constructed variable that includes receptivity to organizational change.[65,83] Corporate culture has been shown to explain significant variation in use of clinical innovations.[83,84] Leadership is defined as the managerial commitment, involvement, and

accountability within the organization.[65,83] Leadership does not refer strictly to the executive level but applies more generally to middle management, unit, or team leaders as well.[65] Positive leadership has a strong relationship with successful implementation of clinical innovations.[39,63] Informal interactions refer to the social networks within an organization.[65] Peer support for a clinical innovation, exerted through informal interactions, has been shown to facilitate adoption and utilization of research evidence.[48,85,86] Social capital is a construct that reflects teamwork or the "bonding, bridging, and linking" of individuals within the organization.[83] Social capital is positively associated with increased research utilization.[65,83]

Ultimately, successful organizational change depends on successful individual change; therefore, we are interested in evaluating several characteristics of individual physical therapists. There is a considerable body of research to indicate that clinicians' attitudes and beliefs effect their research utilization in general, and low back pain management more specifically.[48,49,87-90] Currently, evidence-based guidance recommends clinicians to move away from the traditional biomedical paradigm and embrace a more holistic biopsychosocial approach.[9,91,92] Importantly, physical therapists' attitudes and beliefs regarding these paradigms have been shown to be related to their adherence with these recommendations.[72,93]

Intolerance for uncertainty is an individual trait that stems from negative beliefs about uncertainty and its future recommendations. It is related to anxiety and worry.[94] Clinical uncertainty can act as a barrier to research utilization as clinicians seek to minimize uncertainty and simplify their decision-making process.[95,96] Resistance to change is a multicomponent trait that comprises cognitive, emotional, and behavioral dimensions of change.[97] Clinicians tend to develop clinical routines and habitual patterns based on their own experiences which present a barrier to research utilization.[56,85,98,99] Individual resistance to change has been found to be

negatively associated with organizational behavior change in general, and research utilization more specifically.[56,97-99] Core self-evaluation is a higher order dispositional trait of individuals' general self-concept. It is made up of four lower order traits: self-efficacy, emotional stability, self-esteem and locus of control.[100-102] Core self-evaluations have been associated with variation in research utilization and the ability for individuals' to cope with organizational change.[48,49,80,103,104]

A characteristic of the clinical innovations that has been routinely associated with variation in research utilization is the agreement or acceptability of the research evidence by the clinicians.[39,48,49,104,105] However, the evidence on this construct is mixed. Some studies indicate that high levels of provider acceptance are positively associated with research utilization.[105,106] Still other studies show that providers often do not use research evidence in their clinical decision-making and that even in cases of near universal acceptance utilization is not necessarily achieved.[39,64,85]

Evaluation, which falls within the CFIR process domain, refers to regular performance feedback and discussion through graphs, charts or reports.[65,83] Regular performance reporting has been positively associated with research utilization.[39,83]

1.2 INNOVATION

This project is innovative in the following ways: 1) we will be one of the first to use the CFIR to guide a prospective system-level diagnostic evaluation and develop a tailored implementation prescription; 2) we will investigate the interaction effects between organizational and individual

characteristics on instrumental research utilization; 3) we will design a novel implementation prescription that targets low back pain which is a significant public health issue.

1.3 APPROACH

We will conduct a mixed-method investigation to perform a systems-level diagnostic evaluation and develop an implementation prescription designed to improve the use of LBP guidelines in a large physical therapy organization. Our work will be guided by the Consolidated Framework for Implementation Research (CFIR), a meta-theoretical framework which recognizes five key constructs capable of influencing the integration of research evidence in practice. Those domains are: 1) the outer setting (external environment); 2) the inner setting (organizational context); 3) characteristics of the individuals; 4) characteristics of the clinical innovation; and 5) the implementation process.[65] The CFIR accounts for the complexity of healthcare settings and the multi-level nature of factors that can affect implementation, making it a robust framework for system-level evaluations. Use of the CFIR will mitigate the risk of overlooking theoretically important components within the system while at the same time focusing our information gathering and research efforts.

Mixed-method designs are well suited for examining complex healthcare systems where many factors can act independently or in combination to affect outcomes.[107-109] To accomplish our overarching study goals we will sequentially execute the specific aims of our study, linking both quantitative and qualitative investigations.[107,110] (Figure 2) This combined approach will allow us to leverage the strengths of both research methods.[107] Initially we will conduct a multi-level cross sectional study to identify determinants of variation in physical therapists'

compliance with evidence-based LBP guidelines. We will then use semi-structured interviews with both high and low performing therapists' to thoroughly examine barriers and facilitating strategies related to determinants associated with LBP guideline compliance.

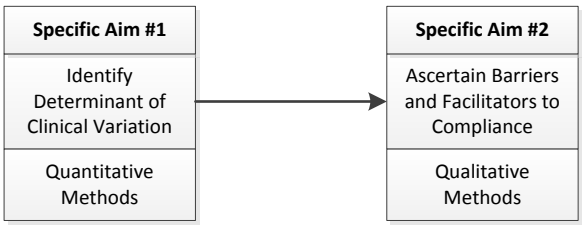


Figure 2. Sequential Mixed Methods Study Design

1.3.1 The Physical Therapy Setting

UPMC is an integrated healthcare organization headquartered in Pittsburgh, Pennsylvania. They operate more than 20 hospitals and 400 outpatient medical clinics, as well as offer an array of rehabilitation, retirement, and long-term care facilities. In this study we are partnering with the CRS, which is a wholly owned subsidiary of UPMC and provides all outpatient rehabilitation services. The CRS has 50 outpatient sites throughout Western Pennsylvania with clinics located in urban and suburban environments. The CRS employs more than 170 full- and part-time physical therapists. The average clinic is staffed by 3.3 full-time equivalents (FTE) but staffing ranges from 1.0 to 26.5 FTE per clinic. The staffing distribution of the clinics is positively skewed with only 20% staffed at levels above the mean. In 2011 the CRS provided physical therapy treatment to more than 4,500 LBP patients.

1.3.2 The Low Back Pain Quality Improvement Initiative

In 2007 the CRS launched a system-wide quality improvement initiative to disseminate and implement evidence-based LBP guidelines throughout their facilities. All patients presenting to a CRS clinic with one of 29 LBP diagnoses (Table 1) are expected to be managed in accordance with the LBP guidelines. Following the physical therapist's initial evaluation of a LBP patient they are required to complete, and upload, a Minimum Data Set (Appendix A) into a clinical surveillance database. The Minimum Data Set (MDS) captures summary information regarding patient characteristics and their LBP history. The MDS also collects examination findings, process of care information and physical therapists' treatment plan. MDS acquisition and storage is a two-step process. First, the data is recorded in patients' medical charts during the initial clinical encounter. Next, the data are abstracted and uploaded into the surveillance database using a proprietary software interface integrated into each clinic's scheduling system. The data maintained in the clinical surveillance system is used to determine compliance with the LBP guidelines. To date CRS has not performed a diagnostic evaluation and only non-tailored implementation interventions have been used. These non-tailored interventions include ongoing large and small group educational sessions supported by detailed internet resources. Bimonthly compliance audits and performance reports are also provided to the physical therapy workforce using data from the surveillance system. Despite these efforts the organization perceives algorithm compliance to be suboptimal.

Table 1. Low Back Pain Initiative (LBI) ICD-9 Diagnoses

ICD-9 Code	ICD-9 Diagnosis Description
721.3	Lumbosacral Spondylosis without Myelopathy
722.10	Displacement of Lumbar Intervertebral Disc without Myelopathy
722.32	Schmorl's Nodes of Lumbar Region
722.52	Degeneration of Lumbar or Lumbosacral Intervertebral Disc
722.93	Other and Unspecified Disc Disorder of Lumbar Region
724.02	Spinal Stenosis of Lumbar Region
724.2	Lumbago
724.3	Sciatica
724.5	Backache, Unspecified
724.6	Disorders of Sacrum
724.70	Unspecified Disorder of Coccyx
724.71	Hypermobility of Coccyx
724.79	Other Disorders of Coccyx
738.5	Other Acquired Deformity of Back or Spine
739.3	Nonallopathic Lesions of Lumbar Region, not Elsewhere
739.4	Nonallopathic Lesions of Sacral Region, not Elsewhere Classified
846.0	Lumbosacral (joint) (ligament) Sprain
846.1	Sacroiliac (ligament) Sprain
846.2	Sacrospinatus (ligament) Sprain
846.3	Sacrotuberous (ligament) Sprain
846.8	Other Specified Sites of Sacroiliac Region Sprain
846.9	Unspecified Site of Sacroiliac Region Sprain
847.2	Lumbar Sprain
847.3	Sprains and Strains of Sacrum
847.4	Sprains and Strains of Coccyx
756.12	Spondylolisthesis
756.11	Spondylolysis, Lumbosacral Region

1.3.3 Low Back Pain Guidelines

The LBP guidelines are the centerpiece of CRS' evidence-based quality improvement initiative. The LBP guidelines are a comprehensive set of evaluation and management decision rules first

developed by Delitto and colleagues at the University of Pittsburgh.[111-116] The decision rules have evolved over time to reflect the best available evidence and are consistent with recent medical and physical therapy LBP Clinical Practice Guidelines.[9,111,117,118] Importantly, previous work has demonstrated that patients treated according to the guidelines achieve better functional outcomes, have lower physical therapy costs, and accrue fewer downstream costs (e.g., medication, imaging, surgery) than those not treated according to these protocols.[78,119,120] Given the congruence with evidence based clinical guidelines and the positive association with important clinical and financial outcomes, CRS would like to maximize compliance rates within their organization.

As operationalized within the CRS, the LBP guidelines use a four-level hierarchy for clinical decision-making.[116,121] The first level identifies LBP patients who should not be managed in the physical therapy setting and requires a medical referral. This is done by screening patients for the presence of significant neurologic deficits or Red Flags indicative of serious medical pathology.[122,123]

Once a patient has been identified as a suitable physical therapy candidate, the decision rules are used to identify the most appropriate management strategy or treatment intervention. The second level of the algorithm begins this process by identifying patients with maladaptive, fear avoidance behaviors, which have been shown to be risk factors for poor outcomes and the development of chronic pain.[124] (Appendix B) This is accomplished using a valid and reliable patient self-report measure.[125] Patients managed within the therapy setting who demonstrate elevated fear avoidance behaviors are to be treated using a bio-behavioral strategy which focuses primarily on education and graded exercise exposure.[126,127] For patients without elevate fear avoidance beliefs the third level of the algorithm is used to classify them into one of three

categories (Stage 1-3) based on their level of functional limitations. Again, this is done by using a valid and reliable patient self-report measure.[127] Patients presenting with moderate to severe limitations are considered Stage 1, those with moderate to minimal limitations are considered Stage 2, and those with minimal limitations are considered Stage 3.[127]

For Stage 1 patients, those with the highest functional limitations, the decision-making algorithm allows the therapist to determine the intervention with the highest probability of treatment success.[111-115,121] This is accomplished by identifying sign and symptom clusters that are predictive of success and then matching the appropriate physical therapy intervention–specific exercise, manipulation/mobilization, stabilization exercise, or traction–in the management of the patient.[128-130] For patients identified in Stages 2 and 3 general conditioning and aerobic exercises are the treatments of choice.[127]

1.3.4 Preliminary Findings Reveals Compliance Gaps

A preliminary assessment of the CRS' LBP quality improvement initiative has been conducted. We sought to quantify program performance, develop an understanding the operational processes utilized in the field, and explore the perceptions of physical therapists and managerial leaders. Our assessment was comprised of retrospective data analyses, observational visits, workflow modeling, and informal interviews with key informants. The goal of this exercise was to identify potential gaps in implementation that warranted further investigation.

A retrospective analysis was conducted using 2011 data from the clinical surveillance database. The CRS' four-level LBP guidelines, as described previously, were used to classify patients into one of seven categories based on the clinical data housed in the surveillance

database. These findings were then compared to physical therapists' self-reported classification for each patient to determine if their initial assessment and plan of care was in compliance with LBP guidelines. One hundred and seventy physical therapists from 46 clinics managed patients within auspices of the LBP quality improvement initiative in 2011. Table 2 provides descriptive statistics and compliance estimates for each classification. Our preliminary results show poor overall compliance (25.7%) with the LBP guidelines and significant differences ($p < 0.0005$) in compliance between classifications. For example, the adherence rate for the specific exercise classification is 80.6% (best) compared to 4.5% for the bio-behavioral classification (worst). We also found significant variation in compliance rates between individual therapists ($p < 0.0005$) and between clinics ($p < 0.0005$).

Table 2. Treatment Based Classification Guideline Compliance

2011 LBP Patient Totals						Algorithm Compliance		
Stage	Classification	Patients	Percent	95% CI		Patients	Percent	Std Err
	BB	2,317	50.8%	49.3%	52.2%	104	4.5%	0.004
1	SE	392	8.6%	7.8%	9.4%	316	80.6%	0.020
	MT	300	6.6%	5.9%	7.3%	74	24.7%	0.025
	STAB	306	6.7%	6.0%	7.4%	169	55.2%	0.028
	Traction	168	3.7%	3.1%	4.2%	26	15.5%	0.028
2	Stage 2	558	12.2%	11.3%	13.2%	236	42.3%	0.021
3	Stage 3	521	11.4%	10.5%	12.3%	246	47.2%	0.022
		4,562				1,171	25.7%	0.006

BB=Biobehavioral; MT=Manual Therapy; SE=Specific Exercise; STAB=Stabilization Exercise

Our data analysis coupled with the onsite observations and informant interviews have yielded insight into these findings. First, there seems to be considerable uncertainty regarding the application of the decision-making guidelines. Many therapists have expressed concerns that more than one classification may apply simultaneously to a given patient. Our own data analysis

shows that 33% of patients do simultaneously meet more than one classification, although this was only true when the guideline hierarchy was ignored. This finding is important because the management of LBP presents considerable diagnostic uncertainty. [96,131] In theory the LBP guidelines are designed to minimize this clinical uncertainty by providing a clear decision pathway for the selection of evidence-based treatment interventions. However, it would appear that this potential benefit has not been fully realized. This situation may be the result of complex guidelines, it may simply reflect the need for more education, or it could be a manifestation of dispositional traits of the decision makers themselves.

Another theme that emerged during our investigation was related to the two patient self-report instruments, both of which drive key pathway decisions in the algorithm tree. More specifically, proper execution of the guidelines requires data from the two self-report measures to be collected and scored contemporaneously with the physical therapists' initial history and examination. As stated previously, one instrument captures data that triggers the bio-behavioral classification by identifying elevated fear avoidance beliefs. The other measure collects data specific to patients' functional limitations, which is critical to appropriately identifying patients in Stages 1-3. Since these data are integral to proper classification, and therefore LBP algorithm compliance, one would expect them to be a high priority in the clinical workflow. To the contrary, our analysis indicated that often these data were not available, and when available were often not used by the therapist at the point-of-care. This is particularly telling when considered in light of the very low compliance with the bio-behavioral classification. As we investigated further there is a common perception among informants that therapists may doubt the importance of elevated fear avoidance behaviors as a risk factor or lack the self-confidence or skills to intervene.

Another observation made during our investigation was the tendency for the physical therapists' self-reported classifications (e.g., biobehavioral, etc.), based on their assessment of the patient, to concentrate in one or two classification categories. For example, we found that 99% of the therapists routinely self-report only one or two classification categories in the majority of their patient populations. Given the observed distribution across the seven classification categories in the total population, this concentration was an unexpected finding. It would be reasonable to expect the distribution of each provider's reported classifications to more closely mirror the broader distribution across all categories observed in the whole population. A legitimate explanation for this observed concentration of reporting would be differences in patient populations between providers are responsible for this phenomenon. Because we are interested in understanding determinant of variation between providers, and we know that variation in patient characteristics can confound these comparisons, we will control for case-mix differences in the current study.[132,133]

Nevertheless, another possible explanation for the concentrated reporting among therapists is that this finding represents habitual clinical decision-making. In other words, clinicians may gravitate to one or two favored interventional approaches, and stick to these approaches habitually instead of executing the guidelines to completion which would increase the probability of a wider distribution across the seven classification categories. This explanation is also consistent with our key informants' perceptions that providers tend to be "creatures of habit." Similarly, there appears to be beliefs that those not trained at the University of Pittsburgh, where these guidelines are taught in the core curriculum, or those who have been in clinical practice longer are "reluctant" or "unwilling" to acquire new skills or change existing practice patterns.

Several organizational characteristics were also cited as potential reasons for low compliance. The size of clinics was perceived to potentially influence compliance rates. Rationale cited for this belief was related to specialization. In other words, larger clinics may have "back specialists" that may be well versed in the LBP guidelines whereas smaller clinics would be staffed with "generalists" that may not have the same command of the specialized guidelines. Also, there appears to be a cultural focus on "productivity" and patient throughput that is felt to place a restriction on the time and resources necessary to properly execute the rules. Finally, there appears to be frustration with the additional administrative burden to document and upload the MDS.

Finally, there were two environmental factors that were raised during our informal interviews with key informants. First, the UPMC health plan, which insures approximately 40% of the low back patients treated at the CRS, instituted an episodic bundled payment methodology in 2012. The bundled payment covers patients with a non-specific low back pain for up to eight weeks of care. The configuration of the bundle requires patients to pay a single $30 co-payment for the entire episode, which significantly reduces their cost share burden. Also, there are several large physical therapy organizations throughout the country that the CRS is competing with in regard to low back pain care.

1.4 PROPOSED AIM #1: IDENTIFY DETERMINANTS OF VARIATION IN ADHERENCE WITH EVIDENCE-BASED LBP TREATMENT GUIDELINES.

1.4.1 Study Design

Healthcare organizations are complex systems and variation in the use of evidence based guidelines can be affected by many factors. Our preliminary investigation within the CRS has revealed poor compliance with the LBP guidelines, which indicates substantial gaps in quality of care. Identification of performance gaps is necessary but insufficient to adequately address the compliance problem. Like medical signs and symptoms, quality gaps are an indication of problems, but they do not provide a definitive diagnosis, nor are they sufficient to determine a prescription for change. Further assessments are needed to understand the factors that are driving the observable quality gaps so specific barriers to compliance can be identified, and solutions to overcome these barriers can be developed.

In this study we are interested in investigating the LBP quality improvement initiative to determine how organizational and clinician characteristics, along with the perceived acceptability of the guidelines drive variation in compliance. We are especially focused on identifying interactions and mutual dependencies between these variables. Importantly, our investigation may be confounded by factors other than those of primary interest. We have chosen a study design and analytic strategy to control for these factors by producing risk-adjusted compliance profiles which will allow equitable comparisons between providers. Valid and reliable survey instruments will also be employed to collect information regarding individual and organizational factors that are theorized to effect LBP guidelines compliance. These data

will be used in conjunction with the risk-adjusted compliance profiles to the quantify main and interaction effects that distinguish between high and low performing providers.

1.4.2 Physical Therapy Cohort

The cohort of physical therapists will be drawn from the CRS's outpatient rehabilitation facilities. They will include all licensed full- and part-time physical therapists that were designated as the clinician of record for at least one patient who met the Low Back Pain Initiative ICD-9 Diagnoses from 1/1/12 to 12/31/12. (Table 1)

1.4.3 Development of Risk-Adjusted Adherence Profiles

Risk-adjusted LBP algorithm compliance rates will be employed to facilitate meaningful comparisons between providers in our cohort by controlling for differences in patient populations.[132,133] Administrative data from the clinical surveillance database for all patients treated within the parameters of the LBP quality improvement initiative during the one year period 1/1/12 to 12/31/12 will comprise the analytic file.

The clinical surveillance database contains 21 patient-related factors that may differ between providers and potentially influence compliance rates. There are three demographic variables, 12 historical variables, and six examination variables. The demographic variables include age, gender, and source of payment (e.g., insurance, self-pay). Four of the 12 historical variables are measures of fear avoidance behavior and functional limitations obtained from valid patient self-report instruments. Six of the historical variables specify the location and history of patients' LBP (e.g., duration, previous surgery). The final two historical variables report the

diagnosis and other body regions affected. Finally, there are five physical examination variables (e.g., straight leg raise, mobility testing).

The analytic dataset from the clinical surveillance database will be randomly split into a development and validation samples. Multi-level logistic regression modeling will be utilized due to the clustered nature of the data (i.e., patients nested within providers nested within clinics). This analytic approach is preferred as it will account for variation between providers as well as variation between clinics. [133,134] Both were found to be significant in our preliminary study. Another benefit of multi-level modeling is that it stabilizes regression coefficient estimates for providers with smaller samples, which is likely to be an issue in the analytic cohort. [133] Standard procedures for development, testing, and validation of risk-adjusted provider performance profiles will be utilized.[132-135] The final validated model will be used to predict the expected LBP algorithm compliance for each provider after controlling for significant patient characteristics. [132,133] The observed compliance rate is then compared to the expected (predicted) rate to calculate a compliance ratio (O_i/E_i).[132,133] Providers with a ratio score greater than one perform better than expected and those with a score less than one are considered to underperform. [132,133] The compliance ratio will be used to rank order each provider from high to low according to their individual risk-adjusted compliance rates.[132,133]

1.4.4 Survey Procedures and Instruments

All clinicians in our Physical Therapy Cohort currently employed at the CRS will be approached for participation in the project. An online survey instrument will be created in SurveyMonkey™ Pro. The instrument will be comprised of two sections. The first section will outline the parameters of the survey and the goals of the project. The second section will contain the survey

items. Since this investigation is a component of a broader quality improvement project we do not anticipate the need to obtain informed consent.

In an effort to secure high response rates a multi-faceted approach will be employed. First, a guarantee of anonymity will be provided for all survey respondents. Only aggregate outcomes will be shared with CRS management and it will be stressed that individual responses will remain strictly confidential. Next, the principal investigator (PI) will enlist help of the CRS Facility Directors (FD). The FD will be approached in the course of their regularly schedule quarterly meetings. At this time the PI will explain the study goals and procedures and stress the confidential nature of the research findings. The FD will be given an informational packet and asked to introduce the study to their physical therapy team at each clinic.

Once the study has been introduced in the individual clinic sites the PI will e-mail an overview of the study along with instructions for accessing the survey to each physical therapist. Each physical therapist will be assigned a unique user name and password to maintain privacy and security. Finally, all survey respondents will be offered at $50 Visa card upon survey completion. The survey will take between 50-60 minutes to complete and we estimate a very high completion rate (>75%).

1.4.4.1 Personal Characteristics, Beliefs and Dispositional Traits

Through our survey procedures we will collect a number of demographic or professional characteristics from each therapist. These variables will be: age, gender, years licensed, training institution, highest degree attained, advanced certifications, and employment status (part/full). (Appendix C) We will also derive a measure of LBP experience by calculating the number of

LBP patients treated as a percentage of their total patients. Finally, the following instruments will be used to determine physical therapists' LBP attitudes and dispositional personality traits.

1.4.4.2 Pain Attitudes and Beliefs Scale For Physical Therapists

The Pain Attitudes and Beliefs Scale for Physical Therapists (PABS-PT) is designed to discriminate between a biomedical and biobehavioral orientation to LBP management in physical therapists and related professionals.[136,137] The instrument was developed using from existing patient self-report measures, such as the Tampa Scale for Kinesiophobia and Fear avoidance Beliefs Questionnaire, and adapted for use with physical therapists through expert review.[136] The original instrument was modified to improve the internal consistency of the biobehavioral subscale.[89,136-138] The revised version contains 19 items, the biomedical subscale has 10 items and the biobehavioral subscale has nine.[136,138] In both the original and revise versions responses are scored on a six-point Likert scale ranging from "Totally Disagree" to "Totally Agree."[136,138] (Appendix D) The instrument can be completed in less than 10 minutes.

Psychometric testing has been performed with physical therapists (n=1,628) in the Netherlands, United Kingdom and Germany.[89,136,138,139] Internal consistency for the biomedical subscale is good (α=0.77-0.84) across all studies.[136,138,139] However, the internal consistency of the biobehavioral subscale is less robust and varies (α=0.54-0.68) depending on the version of the instrument. [136,138,139] Factor, convergent and discriminant validity have been demonstrated in physical therapy populations for both versions.[89,136,138,139] The 19 item, revised version will be employed due to its marginally better psychometric properties.

1.4.4.3 Intolerance for Uncertainty Scale

The Intolerance for Uncertainty Scale (IUS) is designed to measure a dispositional human characteristic that stems from negative beliefs about uncertainty and its future implications.[94,140-142] Intolerance for uncertainty is strongly associated with worry and anxiety.[94,140-142] The IUS was developed in 1994 and has become the standard measure for this construct.[142,143] The survey can be administered in a long (27 items) or short (12 items) version.[94,140] Responses for each version are rated on a five-point Likert scale ranging from "Entirely characteristic or me" to "Not at all characteristic of me." (Appendix E) Two subscales have been identified: the "Desire for Predictability" and "Uncertainty Paralysis."[140,142]

Extensive psychometric testing has been conducted in North America and Europe.[94,140-143] Internal consistency (α=0.91) and test-retest reliability (r=0.78) are excellent for the long form.[94,141,142] Internal consistency is also excellent for the short form (α=0.91) as well as each subscale (α=0.85).[140,142] Factor, convergent, discriminant and criterion-related validity have been established for both the long and short versions of the instrument.[94,140-142] Given the psychometric equivalence between the two versions the 12 item instrument will be used to reduce response bias.

1.4.4.4 Resistance to Change Scale

The Resistance to Change Scale (RCS) is designed to measure individual differences in the dispositional tendency to resist change.[144,145] The measure was developed in 2003 and a series of seven studies conducted in a variety of contexts established the reliability and validity of the measure.[144] The instrument consists of 17 items and with responses scored on a six-point Likert scale that ranges from "Strongly Agree" to Strongly Disagree."[144] There are four subscales: 1)

Routine seeking (5 items), 2) Emotional reaction (4 items), Short-term focus (4 items), and 4) Cognitive rigidity (4 items). (Appendix F) Internal consistency coefficients for the overall measure were 0.87-0.88 and subscale coefficients were 0.75-0.82, 0.71-0.78, 0.71-0.78, and 0.69-0.78 for Routine Seeking, Emotional Reaction, Short Term Focus, and Cognitive Rigidity, respectively.[144] The measure has demonstrated factor, convergent and discriminant validity.[144] In addition, cross cultural validity has been established in a sample of 4,201 university students from 17 countries on four different continents.[145]

1.4.4.5 Core Self-Evaluations Scale

The Core Self-Evaluations Scale (CSES) is designed to measure a dispositional construct of one's general self-concept or the assumptions people make about themselves.[100-102] Core self-evaluation is a higher order construct that is composite of four lower level traits, self-esteem, neuroticism (emotional stability), locus of control, and general self-efficacy.[100] The CSES was intended to specifically measure the unitary construct more efficiently than measuring the four traits independently.[100] Twelve items comprise the instrument and responses are captured on a five-point Likert scale that ranges from "Strongly Agree" to Strongly Disagree."[100] (Appendix G) Internal consistency reliability is good (α=0.81-0.87). Factor, convergent and discriminant validity has been demonstrated.[100]

1.4.4.6 Organizational (Clinic) Characteristics

We will capture several organizational characteristics: number of physical therapists, total number of clinical staff, total number of administrative staff, and clinic zip code. We will also administer the following instruments to capture physical therapists' perceptions about their organization (clinic) and the acceptability of the LBP guidelines.

1.4.4.7 Alberta Context Tool

The Alberta Context Tool (ACT) is designed to measure individual perceptions of organizational context in complex healthcare settings and provide valid and reliable reporting at the individual, clinic, or broader organizational level.[83,146] Development of the instrument was based on relevant knowledge translation theory, including the Promoting Action on Research Implementation in Health Services (PARiHS) framework.[83] The ACT is a 56 item survey which explores 10 domains of organizational context: 1) Leadership, 2) Culture, 3) Evaluation, 4) Social Capital, 5) Informal Interactions, 6) Formal Interactions, 7) Structural And Electronic Resources, 8) Organizational Slack-Staff, 9) Organizational Slack-Space, and 10) Organizational Slack-Time.[146] The number of items per domain ranges from 6-11 and responses are captured using five-point Likert/frequency scales. (Appendix H) The survey can be completed in approximately 10-15 minutes.[83,146]

Psychometric testing of the ACT has been conducted in acute care and long-term care settings in Canada and Europe.[83,146-148] The instrument has been tested primarily with nurses (n=1,748) although the instrument has also been evaluated with approximately 600 physicians, allied providers (including physical/occupational therapists), and clinical team leaders.[83,146,148] Additionally, the instrument has been tested with 645 non-licensed aides.[147] Internal consistence of the ACT subscales is acceptable for the majority of the domains with the exception of Formal Interactions, Structural and Electronic Resources, and Organizational Slack-Space.[83,146-148] (Table 3) Factor and discriminant validity have been demonstrated in multiple healthcare provider populations and settings.[83,146-148]

Table 3. Psychometric Properties of the Alberta Context Tool

Organizational Domain	Cronbach Alpha (Range)
Leadership	0.86-0.91
Culture	0.72
Evaluation	0.74-0.91
Social Capital	0.72-0.77
Informal Interactions	0.70-0.73
Formal Interactions	0.37-0.60
Structural And Electronic	0.54-0.70
Organizational Slack-Staff	0.74-0.92
Organizational Slack-Space	0.63-0.64
Organizational Slack-Time	0.83

1.4.4.8 Ottawa Acceptability of Decisions Rules Instrument

The Ottawa Acceptability of Decisions Rules Instrument (OADRI) is designed to measure the acceptability of algorithmic clinical decision rules to clinicians.[105] Development of the instrument was predicated on Ottawa Model of Research Use and has been refined using survey research methodology, interviews with physicians, and studies of guideline development.[105] The instrument explores several factors that known to represent barriers to research utilization: 1) Evidence Strength and Quality, 2) Complexity, 3) Relative Advantage, and 4) Adaptability.[105] There are 12 items and responses are captured on a six-point scale ranging from "Strongly Disagree" to "Strongly Agree," or the provider may also chose "No Opinion/Don't Know." (Appendix I) The instrument can be completed in 2-3 minutes.[105]

Testing of the OADRI has been conducted using the Canadian C-Spine Rule and the Canadian CT Head Rule with randomly selected Emergency Medicine physicians in Australia (n=417), Canada (n=339), United Kingdom (n=155), and United States (n=239).[105] The instrument can be used with respondents that are unfamiliar or well versed in the decisions rules.[105] This is accomplished by presenting the specific decision rules to the respondent in

conjunction with the survey. Importantly, this administration strategy also allows individual components of guidelines to be assessed separately. Internal consistency is excellent (α=0.78-0.86) and the instrument has shown good convergent and discriminant validity.[105]

1.4.5 Dependent Variables

The dependent variables will be dichotomous measures of each physical therapist's relative ranking within the distribution of risk-adjusted LBP algorithm compliance. The performance distribution will be evaluated to determine natural thresholds for identifying the highest and lowest performing providers. The population will be stratified according to these thresholds and three comparisons will be explored. First, the highest performing cohort of providers will be compared to all lower performing providers. Secondly, the lowest performing cohort of the providers will be compared all higher performing providers. Thirdly, the highest performing cohort of providers will be directly compared to the lowest performing cohort of the cohort.

1.4.6 Independent Variables of Interest

To test our four research hypotheses the total measure scores, or subscale specific scores, from the following instruments will be used.

<u>Hypothesis #1:</u> Physical therapists' LBP beliefs and their dispositional characteristics will be associated with variation in LBP guideline compliance.

Five continuous measures will be tested to determine the relationship between physical therapist characteristics and variation in LBP guideline compliance. These variables include the two

subscale scores for treatment orientation from the Pain Attitudes and Beliefs Scale for Physical Therapists and the total item scores for the Intolerance for Uncertainty, Resistance to Change, and the Core Self-evaluations Scale instruments. For example, we hypothesize that physical therapists' Intolerance for Uncertainty will be negatively associated with LBP guideline compliance.

Hypothesis #2: There will be no relationship between acceptability of LBP guidelines and algorithm compliance.

The Ottawa Acceptability of Decisions Rules Instrument allows individual components of guidelines to be assessed separately. Therefore, this instrument will be used to assess the acceptability of each classification rule. In other words, the 12 item instrument will be used to assess the biobehavioral decision rules; these same 12 items will be used again to assess the specific exercise decision rules. This will be continued until the rules for each classification category have been evaluated. The only exception is that Stage 2 & 3 rules will be assessed together because decision rules and treatment recommendations are virtually identical. As a result we will have six continuous measures to determine the relationship between acceptability of LBP treatment guidelines and guideline compliance. For example, we hypothesize that physical therapists' acceptance of the biobehavioral decision rules will not be associated with biobehavioral guideline compliance.

Hypothesis #3: Organizational characteristics will be positively associated with variation in LBP guideline compliance.

Five continuous measures will be tested to determine the relationship between organizational (clinic) characteristics and variation in LBP guideline compliance. These variables will consist

of scores on the Leadership, Culture, Evaluation, Social Capital, and Informal Interactions subscales of the Alberta Context Tool. For example, we hypothesize that physical therapists' perception of leadership will be positively associated with LBP guideline compliance.

<u>Hypothesis #4:</u> Cross-domain interaction effects between organizational (clinic) and physical therapist (individual) characteristics will be associated with variation in LBP guideline compliance.

All 16 of the independent variables tested in Hypotheses 1-3 will be candidates to test for the cross-domain interaction effects between organizational (clinic) and physical therapist characteristics and the relationship with LBP guideline compliance. For example, we hypothesize that an interaction between physical therapists' perception of leadership and their Core Self-evaluations will be positively associated with LBP guideline compliance.

1.4.6.1 Confounding Variables

Individual and organization characteristics may potentially confound any associations between our dependent variables and the independent variables of interest. To account for this possibility we will control for the professional (e.g., years in practice) and demographic (e.g., age) characteristics of physical therapists and the structural characteristics (e.g., zip code) of the organization (clinic).

1.4.7 Analytic Plan

The analytic dataset will be constructed by combining each physical therapist's LBP guideline compliance ranking, personal and professional characteristics, survey responses, and the

organizational characteristics of their primary clinic. In cases where therapists see patients at more than one clinic the location where they treat the majority of patients will be considered primary. Multi-level logistic regression modeling will be utilized to due to the clustered nature of the data (i.e., providers nested within clinics). This analytic approach is preferred as it will account for variation between providers as well as variation between clinics. Both were found to be significant in our preliminary study.

Multi-level modeling has two other added benefits. First, this analytic method stabilizes regression coefficient estimates for providers with smaller samples, which is likely to occur in our analytic dataset. Secondly, this approach will allow us to test independent variables at different levels of the clustered hierarchy. In this study we have conceptualized the physical therapists' demographic and professional characteristics, dispositional personality traits, and LBP attitudes as Level 1 variables. This is the lowest level of the hierarchy. The organizational characteristics of their primary clinic and perceived acceptability of the decision rules will be designated as Level 2 variables. The rationale for including the acceptability of the decision rules as Level 2 variables stems from the fact that these guidelines were imposed upon providers by the organization as part of CRS' quality improvement program.

Our four hypotheses will be tested by fitting separate multi-level logistic regression models for the three dichotomous dependent variables–H:25%/L:75%, H:75%/L:25%, and H:25%/L:25%–while controlling for potential confounders. Comparative descriptive statistics will be generated for each independent variable (Levels 1 and 2) separately for the three dichotomous dependent variables.

Univariate analyses will be conducted to explore the association between each dependent variable and all independent and confounding variables. The regression coefficients and

statistical associations will be reported. The regression coefficients and statistical associations will be reported. Variables with univariate statistical associations at $\alpha \leq 0.15$ will be retained and these data will be used to build preliminary multivariable models.

Testing of each research hypothesis will be conducted in the same systematic manner. First, we will fit a full model, which contains the significant independent variables of interest, confounding variables, and all 2 x 2 combinations of the independent variables of interest.[149] We will use hierarchical backward elimination with a threshold for removal $\alpha \leq 0.15$.[149] Each variable will be evaluated individually and removed manually if they exceed the threshold. The interaction terms will be assessed first followed by the lower order variables.[149] Model diagnostics will be performed and re-estimation will be conducted as necessary until the most parsimonious models are obtained. Regression coefficients and odds ratios for each risk factor in the final models will be reported. Findings will be considered statistically significant at $\alpha \leq 0.05$.

1.4.7.1 Sample Size and Power

When conducting analyses using multi-level regression models there are three primary considerations when determining sample size. Those factors are the number of levels in the hierarchy, the levels in the hierarchy at which the variables of interest reside, and whether fixed or random coefficients are being tested.[150,151] When testing our four hypotheses we will have a three-level hierarchical structure (i.e., therapist and clinic) in which we are looking for fixed effects at both levels. Given our study design and research objectives the highest level (i.e., clinic) in the hierarchical structure becomes the limiting factor.[150,151] Furthermore, when looking for cross-domain interactions, as we are in this study, it is recommended that the highest level

have at least 20 "units" to achieve adequate power ($\beta = 0.80$) to detect changes at $\alpha = 0.05$.[150,151] In our preliminary analysis we found that physical therapists in 46 of the CRS' 50 clinics treated patients as part of the LBP quality improvement initiative. The CRS has indicated that this number will be even higher in the 2012 dataset. Therefore, we should be well above the minimum threshold of 20 clinics and adequately powered in our study.

1.4.7.2 Potential Limitations

The LBP guideline compliance data are based on self-report and require data entry by the physical therapists, which may affect the validity of our conclusions. However, this limitation should be minimal since the data are part of the patients' official clinic record and are subject to random quality audits. The use of survey for data poses another potential limitation to our study. These data may be subject to social acceptability bias, which may affect the validity of our conclusions. Again, we don't anticipate this to be a substantial issue given our confidentiality policy and the fact that only aggregate findings will be shared with the employer. Finally, there is the potential for low survey response rates. We believe that our multifaceted approach as described above will yield high rates of return. If that is not the case, and our response rates fall below our target we will institute follow-up measures, including but not limited to, e-mail reminders along with supportive communications from the CRS leadership.

1.5 PROPOSED AIM #2: CONDUCT SEMI-STRUCTURED INTERVIEWS WITH PHYSICAL THERAPISTS TO ASCERTAIN BARRIERS TO COMPLIANCE WITH THE EVIDENCE-BASED LBP GUIDELINES.

1.5.1 Study Design

Barriers to research utilization can result from many factors and exist on multiple levels. Quantitative research methods, as proposed in Specific Aim #1, can identify relationships between various factors, and determine their association with variation in research utilization. However, these methods do not necessarily identify or reveal the mechanism at work. In other words, quantitative research does not tell us why these factors are barriers to research utilization, how they act to influence guideline compliance, nor can it tell us how high performing providers have successfully overcome the barriers. To answer these questions we must employ qualitative methods.

In this study we will utilize semi-structured interviews with high and low performing physical therapists to identify barriers to compliance with the LBP guidelines and understand how these barriers produce their unwanted effects. We have chosen to use semi-structured interviews over focus groups for two reasons. First, clinicians are very busy and their time is valuable, therefore it will be more efficient to accommodate individual schedules, thereby facilitating recruitment. Secondly, we are interested in deeply understanding the individual perceptions, concerns, and difficulties with compliance, which are more effectively explored in one-on-one interviews.

As with Specific Aim #1 we will use the CFIR as the overarching structure to guide our investigation. In addition, we will use findings from our quantitative study to further focus our information seeking and define our sampling frame. More specifically, we will use the results obtained in Aim #1 to direct our data collection towards variables and relationships that appear to drive variation. Additionally, we will use those data to target high and low performers with purposeful sampling to ensure maximum variation in viewpoints.

The use of qualitative methods can be particularly helpful in implementation research by elucidating the context around quantitative relationships and teasing out subgroup differences.

1.5.2 Physical Therapy Cohort

Physical therapists will be recruited from within the CRS system using stratified purposeful sampling. The goal of our sampling method is to achieve maximum variation across two parameters: compliance rate and specific LBP guideline decision rules (e.g., biobehavioral, specific exercise). [152] To achieve this goal we will use the results from our quantitative study to recruit at least three physical therapists from the top and bottom quarter of the risk-adjusted performance distribution for each LBP decision rule. We will continue sampling until thematic saturation is achieved.

1.5.3 Interview Procedures

Telephonic semi-structured interviews will be conducted with all study participants. The PI will conduct, and digitally record, interviews using a standardized interview guide. The interview guide will be developed using the CFIR constructs for the environmental domain, which we were

unable to examine in Specific Aim #1. The will also be developed to specifically investigate the significant findings captured in our quantitative study. The guide will be tested and trained with a convenience sample of physical therapists not targeted for recruitment because their compliance rates fall in the middle of the performance distribution. Interviewees will be contacted by telephone and asked to participate in the study. Interviews will only be conducted following informed consent and with individuals willing to allow digital recording. All interview recordings will be transcribed verbatim.

1.5.4 Analytic Plan

The data obtained from the semi-structured interviews will be coded using Crabtree and Miller's editing style of analysis. According to this method the analyst approaches the data without a predefined coding template and tries to put aside any a priori hypotheses about the potential results. [153] The analyst then uses an iterative process to first identify all small passages within the data that are relevant to the study. [153] The analyst then works to sort these passages into logical categories, and then uses the categories to identify major themes within the content. [153] This process is repeated until no new themes emerge and the richest and most relevant meaning has been obtained from the available data. [153]

The PI will perform all coding and construct a codebook for data. The iterative methodology described above will be utilized to develop the content analysis. The codebook will be constructed using 50% of the available data and the coder will be blind to the level of the organization from which the data was obtained. Following this the other 50% of each dataset will analyzed to identify recurring and important new codes. This potentially broader coding scheme will then be used to re-review the initial subgroup of data and the process repeated until

a stable set of codes, categories, and themes are defined. To facilitate the analysis and codebook construction NVivo 10™ computer software will be utilized.

Results from our data analysis will be organized into major themes. These results will then be augmented by data from our quantitative investigation into the determinants of variation in compliance rates. [107,110] The qualitative and quantitative data will be triangulated to improve credibility and bring greater richness to the assessment. [152] Finally, we will compare our major themes to CFIR constructs as we seek to place our findings in the context of mutable barriers or effective facilitation strategies amenable to an implementation intervention.

2.0 IDENTIFYING FACTORS ASSOCIATED WITH ADHERENCE TO LOW BACK PAIN GUIDELINES: AN EXPLORATORY ANALYSIS

2.1 BACKGROUND

Our healthcare system is in the midst of dramatic change. As the focus moves from volume to value, healthcare providers, systems and payors are looking for ways to improve the quality and efficiency of care. To achieve these goals evidence-based strategies must be implemented. However, gaining adoption, implementation, and sustained use of evidence-based interventions is difficult. Nowhere is this more evident than in the management of low back pain (LBP). Despite 20 years of guideline dissemination recent studies indicate that LBP care is becoming more discordant with evidence-based recommendations.[13-15,154]

One reason for the disappointing results is the multifactorial nature of the barriers to widespread practice change. Barriers may be external to an organization; they can be created by internal structure and processes; they may result from characteristics of the organization's personnel; or they may be a direct function of the evidence that the organization is trying to implement. External barriers to implementation may include financial disincentives, regional standards of practice, and poor interprofessional cooperation.[17,18,48,53,55] Similarly, poor leadership, lack of resources, administrative constraints, and cultural climate have been identified as internal barriers to implementation of evidence-based care.[17,18,48,53,55] Other organizational

barriers can include structural or process related issues such as, inadequate team cooperation, poorly defined professional roles, lack of authority to affect change, and ineffective communication. Finally, there has been considerable research showing that individual knowledge, attitudes, and skills can all act as barriers to implementation of a clinical innovation.[17,18,48,53,55]

The Consolidated Framework for Implementation Research (CFIR) is a theoretical framework that reflects this complexity of the factors that can affect the routine use of evidence-based interventions. The CFIR identifies 5 domains and over 40 constructs that have been found to influence implementation. The domains and constructs include:

1) Outer setting (e.g., patient needs, peer pressure, external policies & incentives);
2) Inner setting (e.g., leadership, culture, networks & communication, goals & feedback);
3) Characteristics of individuals (e.g., knowledge & beliefs, personal attributes);
4) Characteristics of the clinical innovation (e.g., evidentiary strength, complexity); and
5) Implementation process (e.g., planning, opinion leaders, champions)

In this study we are capitalizing on one large outpatient physical therapy organization's multiyear effort to improve the management of LBP. Despite iterative cycles of implementation efforts, the details of which have been published elsewhere, use of the LBP guidelines remains suboptimal.[155] We are using the CFIR as a system level explanatory framework to explore factors associated with adherence to LBP guidelines and identify potential cross-domain interactions. More specifically we hypothesize that:

Hypothesis #1: Organizational characteristics will be associated with variation in LBP guidelines adherence.

Hypothesis #2: Acceptability of LBP guidelines will **not** be associated with variation in LBP guidelines adherence.

Hypothesis #3: Personal attributes of physical therapists will be associated with variation in LBP guidelines adherence.

Hypothesis #4: Interaction effects between organizational characteristics, acceptability of LBP guidelines and the personal attributes of physical therapists will be associated with variation in LBP guidelines adherence.

2.1.1 Physical Therapy Setting

The University of Pittsburgh Medical Center (UPMC) is a nonprofit integrated finance and health care delivery system headquartered in Pittsburgh, Pennsylvania. It operates more than 20 hospitals, 500 outpatient locations, and offers an array of rehabilitation, retirement, and long-term care facilities. The UPMC Centers for Rehab Services (CRS), a component of the Community Provider Services division of UPMC, provides all inpatient, long-term care and outpatient physical therapist services.

The UPMC and its insurance division, UPMC Health Plan, identified LBP as a high-impact condition based on the prevalence and cost of care within their membership. As a result, an enterprise-wide, multidisciplinary low back initiative involving physicians, physical therapists, and the health plan was launched in 2005. The initiative had 3 main components: (1) a 72-hour algorithm to encourage early referral for physical therapy for patients with LBP, (2) dissemination of evidence-based management guidelines at all levels of care, and (3) collection

of detailed data regarding processes of care, clinical decision-making, and physical therapist adherence to LBP management guidelines in the outpatient setting.[155]

The CRS has more than 60 outpatient clinics located throughout western Pennsylvania, including sites in urban, suburban, and rural environments. Since the inception of this initiative the CRS have implemented a number of evidenced based inventions in an effort to optimize adherence to the guidelines. This iterative cycle of quality improvement has been described in detail elsewhere.[155]

The centerpiece of the initiative within the CRS is the Treatment Based Classification (TBC) guidelines. The TBC guidelines are a comprehensive set of evaluation and management decision rules first developed by Delitto and colleagues at the University of Pittsburgh.[111-116] The decision rules have evolved over time to reflect the best available evidence and are consistent with recent medical and physical therapy LBP Clinical Practice Guidelines.[9,111,117,118] Importantly, previous work has demonstrated that patients treated according to the TBC recommendations achieve better functional outcomes, have lower physical therapy costs, and accrue fewer downstream costs (e.g., medication, imaging, surgery) than those not treated according to these protocols.[78,119,120]

As operationalized within the CRS, the TBC guidelines use a four-level hierarchy for clinical decision-making.[116,121] (Appendix B) The first level screens out patients requiring a medical referral whose condition may not be appropriately treated in physical therapy setting. This is done by screening patients for the presence of significant neurologic deficits or Red Flags indicative of serious medical pathology.[122,123]

Once a patient has been identified as a suitable physical therapy candidate, a series of decision rules are used to identify the most appropriate rehabilitation management strategy or

treatment intervention. The process begins by identifying patients with maladaptive, fear avoidance behaviors that have been shown to be risk factors for poor outcomes and the development of chronic pain.[124] This is accomplished using the Fear Avoidance Beliefs Questionnaire, a valid and reliable patient self-report measure.[125] Patients managed within the therapy setting who demonstrate elevated fear avoidance behaviors are to be treated using a bio-behavioral strategy which focuses primarily on patient education, graded exposure to activities or quota based exercises.[126,127] For patients without elevated fear avoidance beliefs the next level of the TBC is used to classify them into one of three categories (Stage 1-3) based on their level of functional limitations. This is done using the Modified Oswestry Disability Questionnaire, a valid and reliable patient self-report measure.[127] Patients presenting with moderate to severe limitations are considered Stage 1, those with moderate to minimal limitations are considered Stage 2, and those with minimal limitations are considered Stage 3.[127]

For Stage 1 patients, those with the highest functional limitations, the decision-making algorithm allows the therapist to determine the intervention with the highest probability of treatment success.[111-115,121] This is accomplished by identifying the clinical sign and symptom clusters that are predictive of success and then matching the appropriate physical therapy intervention–specific exercise, manipulation/mobilization, stabilization exercise, or traction–in the management of the patient.[128-130] For Stage 2 patients general conditioning and aerobic exercises are the treatments of choice and task- or sport-specific training is to be used with Stage 3 patients.

2.2 STUDY DESIGN

This was a two part study using a cross-sectional design. The first part of the study used routinely collected administrative data to determine physical therapists' adherence to the TBC guidelines and develop risk adjusted provider performance profiles. In the second part of the study physical therapists were surveyed regarding factors associated with implementation success. The survey data were then merged with the risk adjusted profiles to identify factors associated with guideline adherent performance. This study was approved as a quality improvement project by the UPMC Institutional Review Board (0001316).

2.2.1 Risk Adjusted TBC Adherence Performance Profiles

The ultimate goal of the study was to identify factors that influence physical therapists' performance as measured by TBC guideline adherence. However, comparisons of provider performance can be biased when the patients they care for differ in important background or clinical characteristics. When patient characteristics are not accounted for, providers with young, healthy patient populations may appear to have a better performance profiles than those with older, sicker patient populations. Therefore, without appropriate risk or case mix adjustment, providers who care for more complex patients may be identified as poor performers, which can lead to inappropriate conclusions regarding the cost or quality of care. Adequate risk adjustment, on the other hand, makes it possible identify systematic differences in performance between providers thereby facilitating meaningful comparisons.[133] The first step in the analysis was to construct risk adjusted TBC performance profiles for each provider. This measure of TBC adherence will then be used as the dependent variable in Step 2 of the analysis.

2.2.1.1 Data Sources and Linkages

The CRS analytics team extracted data for the first phase of the study from two internal databases. First, the organization's billing system was queried to identify all patients aged 18 years or more who received a new patient evaluation for a primary complaint of LBP between July 1, 2012, and June 30, 2013. The new patient evaluation was identified by Current Procedural Terminology Code (CPT) 97001, Physical Therapy Evaluation. A primary complaint of LBP was identified using one of 21 International Classification of Disease Nine Codes (ICD-9) Table 1 in the first position of the billing record. In addition to the ICD-9 and CPT fields, this data source contained patients' age and gender as wells as the payor responsible for the physical therapy charges.

Next, using the patient ID, LBP patients were linked to an Outcomes surveillance database. This data source provides information captured via a Minimum Data Set (MDS) which contains detailed information about a patient's LBP history as well as data generated by the physical therapist in the form of examination findings, process of care information and their treatment plan. (Appendix A) MDS acquisition and storage is a two-step process. Following the physical therapist's initial or re-evaluation the clinical findings are recorded in patients' medical chart. Next, data from the chart is entered into the Outcomes surveillance database using a proprietary software interface integrated into each clinic's scheduling system. The data maintained in the clinical surveillance system can then be used to determine adherence to the LBP guidelines at the individual patient level.

2.2.1.2 Data Preparation and Cleansing

As stated previously, when a patient has been identified as a suitable physical therapy candidate, the TBC decision rules are designed to synthesize information from the patient's history and the physical therapist's examination to help them identify the most appropriate rehabilitation management strategy or treatment intervention. Based on the TBC there are seven possible classifications: Biobehavioral, Directional Preference, Manual Therapy, Stabilization Exercise, Traction, Stage 2 and Stage 3. Before the physical therapists' TBC adherence could be evaluated the correct classification had to be determined. To achieve this a comprehensive coding algorithm was developed in collaboration with academic and clinical experts at the University of Pittsburgh to allow identification of the guideline recommended approach for each patient within the dataset. (Appendix J) Two independent coders manually applied the coding algorithm and their work was compared. Interrater reliability was excellent (Kappa = 0.9995, $p > 0.0001$). Where coding discrepancies existed the PI adjudicated the differences.

Of the 6,408 records in the data set there were 270 (4%) for which the guideline recommended classification could not be ascertained due to insufficient clinical information. For this reason these records were excluded. Of the remaining records, 41% represented data captured at the initial encounter and 59% were associated with data during a re-evaluation. However, the data captured at the re-evaluation could not be used. According to the CRS' organizational protocol each patient's historical information, some of which is necessary to determine guideline adherence, is only submitted following the initial encounter. When data from a re-evaluation is stored in the database, the system does not leave these fields blank but instead copies the historical information from the initial evaluation into the re-evaluation record. As a result, the re-evaluations records contain a mixture of "old" historical information from the

initial evaluation and "new" data pertaining to the examination and treatment plan from the re-evaluation. This mixture of old and new clinical information could result in misclassification bias; therefore only the initial evaluation records were retained. This left 2,642 records. Importantly, each of these records represented the initial clinical evaluation by the physical therapist.

2.2.1.3 Dependent Variable

The dependent variable was a dichotomous variable (Yes/No) indicating whether the physical therapists' treatment plan for each patient as reported on the MDS was in concordance with the guideline recommendations as determined by the procedure described above.

2.2.1.4 Independent Variables

The independent variables were classified into three categories: (1) patient characteristics, (2) physical therapist characteristics, and (3) clinic characteristics. Patient demographic variables included a continuous measure of age and a dichotomous gender indicator. The dataset also included several baseline clinical variables at the patient level. This included continuous measures of pain (0–10 scale) and the Modified Oswestry Disability Questionnaire score (0-100). We used a single dichotomous variable indicative of patients with high fear avoidance beliefs. A patients was considered positive when the Work Subscale score was greater than 28 or the Physical Activity Subscale score was greater than 14. We used a three level categorical variable pain location indicating whether the patient complained of axial back pain only, axial back pain with leg pain not past the knee, or axial back pain with leg pain extending beyond the knee. Pain duration was categorized as 15 days or less or more than 15 days. There were 45 observations (1.7%) with pain duration missing. These were assigned the most frequently

occurring value (more than 15 days). There were two variables addressing the frequency of LBP episodes. The first was a four-level categorical quantifying the number of past LBP episodes as none, 1-2, 3-5, or more than 5 episodes. This variable was missing 73 observations (2.7%). These were also assigned the most frequently occurring value (1-2 past episodes). The other frequency variable indicated whether the painful LBP episodes were increasing over time (Yes, No, Unknown). The unknown category was created for this variable because more than 5% of the observations were missing values. A seven category variable was also created for insurance coverage the values of which included Commercial, Medicare Advantage, Medicare fee-for-service, Medical Assistance, Private Pay/Charity, Personal Injury, and Workers' Compensation. Finally we used two categorical variables related to the clinical guideline classification. These were Clinic Stage (Stage 1, Stage 2, Stage 3) and Treatment Category (Biobehavioral, Directional Preference, Manual Therapy, Stabilization Exercise, Traction, Stage 2 and Stage 3)

Physical therapist demographic characteristics included a three level categorical age variable (25-39 years, 40-54 years, 55-70 years) and a dichotomous race variable (White, Other). We also had continuous measures of their years in practice and years with the CRS.

Clinic characteristics included a geographic variable (North Central, North West, South, East, West) and a count of the number of physical therapists as a proxy for clinic size.

2.2.1.5 Statistical Analysis

Stata Release 14.0 (College Station, Texas 77845 USA) was used for all analyses. Descriptive statistics were calculated for the characteristics of patients, physical therapists, and clinics. Risk adjustment was achieved by fitting a series of multilevel, mixed effects logistic regression models. A multilevel analysis was necessary because the data had a hierarchical structure in that

patients (level 1) were nested in the sample of physical therapists (level 2), who were in turn nested within CRS clinics (level 3). Data with a nested structure violates the independence assumption required in traditional regression analyses, which may result in biased standard errors and p values.[156] Random intercepts were allowed at the physical therapist and clinic levels. Multilevel, random intercept models are preferred for provider profiling because they account for variation between providers and clinics, they stabilize regression coefficient estimates for providers with smaller samples, and they protect against Type 1 errors.[132]

A three-level "intercept-only model" was fit with random intercepts at the clinic and physical therapist levels. This model, without any predictor variables, establishes the contribution of each level to the total variation in TBC adherent care (i.e. the dependent variable) and allows the intraclass correlations (ICC) to be estimated. The ICC is used to measure the degree to which patients are similar within a physical therapist's practice and the degree in which physical therapists are similar within their respective clinics. Within the context of multi-level regression models an ICC of 0.10 or higher indicates the need to account for the nested structure of the data at that level.[157] The ICC was estimated following the regression. The ICC at the clinic level was 0.01 and was 0.18 at the physical therapist level. These findings indicated that the variation between clinics was negligible and did not need to be accounted for in the regression models; however, there was important variation between therapists. Based on this finding we fit two-level models (patients nested in physical therapist) for the remainder of the analyses. However, to control for potential site effects, the region and clinic size variables were included at the physical therapist level.

In the main analysis all continuous variables were group mean centered. There were 51 missing ODI scores and 49 missing pain scores. These observations were assigned a centered

value of zero (i.e., the mean value for the group). Using the two-level intercept-only model, a univariate analysis was performed to screen each independent patient and physical therapist variable to determine the association with guideline adherent care. Two conditions needed to be met for an independent variable to be included in the multivariable analysis. First, the p-value had to be < 0.15, and secondly, the variable could not show a bivariate correlation > 0.80 with another independent variable at that level. Spearman correlations between all predictor variables meeting the first criterion were examined.

Following the univariate analysis a series of models were fit using a forced backward stepwise elimination. First, all patient level variables meeting the criteria described above were forced into the two-level random intercept model. Variables were removed one at a time if the p-value exceeded 0.15 beginning with the variable that had the highest p-value. This process was then repeated for the physical therapist level variables. Finally, all remaining patient and physical therapist level variables (with a p-value of < 0.15) were included in a model simultaneously and examined in the same fashion. Model fit statistics and likelihood ratio tests were conducted to evaluate each model. This allowed the identification of the best fitting model.

With the best fitting model identified a performance index for each provider was calculated. To do this the final model was used to predict the probability of guideline adherent care (i.e., yhat) for each observation while controlling for patient and provider characteristics. The predicted probabilities for each provider's patient population were summed to calculate the expected number of adherent cases. A performance index was calculated for each provider by dividing the observed number of adherent cases in the dataset by the expected number of adherent cases (O / E) derived from the model predictions.[132] Ninety-five percent confidence intervals for each provider's point estimate were calculated as (O ± 2*Standard Error) / E where

the standard error is $\sqrt{\Sigma(yhat(1-yhat))} / \sqrt{n}$.[132,158] Performance index values greater than 1.0 indicate above average performance and values less than 1.0 indicate suboptimal performance.

2.2.1.6 Results

The analytic dataset consisted of 2,642 patients who were treated by 112 physical therapists in 46 different clinics.

Patient Characteristics

A detailed description of the patient characteristics is presented in Table 4. Patients were mostly female (56.7%) and middle aged with a mean of 53.4 years. The mean pain score was 6.8 (1 to 10 scale) and patients had a mean Oswestry Disability score of 37.2 (1 to 100 scale). Over 55% of patients demonstrated high fear avoidance beliefs at baseline. Axial LBP only and axial LBP with leg pain extending beyond the knee were the most common complaints at 38.3% and 36.2% respectively. For the vast majority of patients (86.9%) the pain had been present for more than 15 days. In approximately 31% of the cases this was the first episode, 34.2% had had 1–2 previous episodes and almost a quarter of the patients had experienced more than five episodes. Most patients, 62.8%, reported that the frequency of their LBP episodes was not increasing. The most common clinical stage was Stage 1 (65.0%), followed by Stage 2 (21.2%), and Stage 3 (13.8%). The Biobehavioral classification was the dominant category (55.6%) with the Directional Preference, Manual Therapy, Stabilization Exercise, and Traction categories making up a combined 21.6%. Stages 2 and 3 made up the rest. Commercial insurance coverage was most common (54.7%) followed by Medicare Advantage (18.7%).

Physical Therapist and Clinic Characteristics

The physical therapists were mostly female (56.3%), white (94.6%) and between the ages of 25 – 39 years (64.3%). They averaged 12.8 years in physical therapy practice and were employed by CRS a mean of 7.1 years. The majority of the clinics are in the East region (37%), followed by the North Central region (21.7%), and the South region (17.4%). The mean number of physical therapists per clinic was 2.4 with a range of 1 to 23. Thirteen of the clinics (28%) were staffed by one physical therapist. (Table 5)

Univariate Multilevel Mixed Effects Logistic Regression

The results of the univariate analysis are presented in Table 6. There were a total of eight variables with a p-value less than 0.15. Five of these variables represented clinical characteristics of the patients LBP complaint. They were the group mean centered Oswestry Disability and Pain scores, Fear Avoidance Beliefs, Pain Duration and the Number of Previous LBP Episodes. Two of the variable meeting the screening criteria were related to the guidelines, Clinical Stage and TBC Classification, respectively. The final variable meeting the initial screening criterion was Insurance Type. Spearman correlations showed that high fear avoidance beliefs were strongly correlated with the TBC Classification ($r = -0.9453$) and the centered Oswestry Disability Score was highly correlated with the Clinical Stage ($r = -.8116$). As a result only two of these four variables, the Fear Avoidance Beliefs and group mean centered Oswestry Disability Score, were carried through to the multivariable analysis. These two variables were retained because they have high clinical face validity. All variables that met the screening criterion and were not highly correlated with other independent patient level variables were also used in the multivariable analysis.

There were three physical therapist level variables with a p-value less than 0.15. These were Age, Years in Practice, and Clinic Region. The physical therapist level Age variable was highly correlated with Years in Practice (r = 0.8125). Therefore, only Age and Clinic Region were included in the multivariable analysis.

Multivariable, Multilevel Mixed Effects Logistic Regression

The results of the two level Null model (i.e., intercept only) and the final Patient, Physical Therapist, and Combined Models are presented in Table 7. The Null model showed an ICC of 0.19 (95% CI 0.13 – 0.26).

All patient level variables were forced into the two level model. Pain duration was the first to be removed (p = .995) followed by Number of LBP Episodes (p= 0.562). The four variables to remain in the final patient level were centered Oswestry Disability Score, centered Pain Score, Fear Avoidance Beliefs, and Insurance Type. All were statistically significant demonstrating p-values < 0.05.

At the physical therapist level Age and Clinic Region were forced into the two level model. Both were retained in the model although neither was statistically significant. The p-value for Age was 0.09 and 0.10 for Clinic Region.

These four patient level variables and two physical therapist level variables were forced into a combined model. All six variables were retained. The four patient level variables remained statistically significant: centered Oswestry Disability Score (OR = 1.03, p<0.00, centered Pain Score (OR = 1.06, p=0.02), High Fear Avoidance Beliefs (OR = 1.34, p<0.00) and Insurance Type (OR = 1.04, p=0.02). The odds ratio for physical therapist level variable Age was 0.75 (p=0.09) and Clinic Region 0.90 (p=0.13). The Likelihood Ratio test was used to compare

the combined model with the patient only and physical therapist only models. The combined model was significantly different from both the patient only model ($chi^2 = 6.13$, $p<0.05$) and the physical therapist only model ($chi^2 = 195.31$, $p<0.00$).

Physical Therapists' Treatment Based Classification Adherence Index

The final combined model was used to create the Adherence Index as described above. Again, values above 1.0 represent better than average performance and those below suboptimal performance. In this sample the mean was 0.911 with a standard deviation of 0.468. Values ranged from 0 to 3.22. Figure 3 show the distribution of Performance Index scores. The distribution is positively skewed with a median of 1.01 and an interquartile range of 0.22. Figure 4 shows the relative ranking of therapists by performance with the 95% confidence interval for each point estimate. The confidence intervals at each end of the distribution are wide, which represents imprecise performance estimates. Additionally, the confidence intervals across the distribution are overlapping, indicating that there are not providers whose performance is considered statistically different from their peers.

Table 4. Patient Characteristics

(n=2,642)	Frequency	Percentage	Mean	SD
Age (years)			53.4	16.6
Gender				
Female	1,499	56.7		
Male	1,143	43.3		
Oswestry Score			37.2	17.4
Pain Score			6.8	2.5
High Fear Avoidance Beliefs				
No	1,169	44.4		
Yes	1,473	55.6		
Pain Location				
Axial Pain Only	1,014	38.4		
Axial Pain + Leg Pain Above Knee	672	25.4		
Axial Pain + Leg Pain Below Knee	956	36.2		
Pain Duration				
≤ 15 Days	345	13.1		
> 15 Days	2,297	86.9		
Number of Previous LBP Episodes				
None	816	30.9		
1 – 2	904	34.2		
3 – 5	270	10.2		
5+	652	24.7		
LBP Episode Frequency Increasing				
No	1,659	62.8		
Yes	821	31.1		
Unknown	162	6.1		
Clinical Stage				
Stage 1	1,714	65.0		
Stage 2	559	21.2		
Stage 3	369	13.8		
TBC Category				
Biobehavioral	1,473	55.6		
Directional Preference	198	7.6		
Manual Therapy	116	4.5		
Stabilization Exercise	143	5.4		
Traction	108	4.1		
Stage 2	334	12.6		
Stage 3	270	10.2		
Insurance Type				
Commercial	1,446	54.7		
Medicare Advantage	495	18.7		
Medicare Fee for Service	146	5.5		
Medical Assistance	251	9.5		
Private Pay	8	0.4		
Personal Injury	75	2.8		
Workers' Compensation	221	8.4		

SD = Standard Deviation; LBP = Low Back Pain; TBC = Treatment Based Classification

Table 5. Physical Therapist and Clinic Characteristics

Physical Therapists (n=112)	Frequency	Percentage	Mean	SD
Age				
25 – 39 Years	72	64.3		
40 – 54 Years	31	27.7		
55 – 70 Years	9	8.0		
Gender				
Female	63	56.3		
Male	49	43.7		
Race				
White	106	94.6		
All Others	6	5.4		
Years in Practice			12.8	10.5
Years with CRS			7.1	6.2

Clinics (n=46)	Frequency	Percentage	Mean (SD)	Range
Region				
North Central	10	21.7		
North West	6	13.0		
South	8	17.4		
East	17	37.0		
West	5	10.9		
Number of Therapists			2.4 (2.6)	1-24

CRS = UPMC Centers for Rehab Services

Table 6. Univariate Results from Multilevel Mixed Effects Logistic Regression

Level and Variable	Univariate Analysis		
	OR	SE	p
Level 1 - Patient (N = 2,642)			
Patient Age (Group Centered)	1.00	0.00	0.57
Patient Gender	0.96	0.09	0.62
Oswestry Score (Group Mean Centered)[1]	1.04	0.00	0.00
Pain Score (Group Mean Centered)[1]	1.18	0.02	0.00
High Fear Aviodance Beliefs (Y/N)[1]	2.00	0.18	0.00
Pain Location	1.00	0.05	0.93
Pain Duration[1]	0.82	0.11	0.14
Number of Previous LBP Episodes[1]	1.07	0.04	0.10
LBP Episode Frequency Increasing	0.96	0.10	0.71
Clinical Stage	0.36	0.03	0.00
TBC Category	0.95	0.02	0.05
Insurance Type[1]	1.07	0.02	0.00
Level 2 - Physical Therapist (N = 112)			
Age[1] (15 Year Bands)	0.73	0.11	0.05
Gender	0.99	0.20	0.94
Race	1.66	0.75	0.26
Years in Practice	0.99	0.01	0.12
Years with CRS	0.98	0.02	0.29
Clinic Region[1]	0.88	0.06	0.05

OR = Odds Ratio; SE = Standard Error; LBP = Low Back Pain; CRS = UPMC Centers for Rehab Services

[1]Variable included in multivariable models in the p-value > 0.15 and it was not highly correlated (>0.80) with another independent variable

Table 7. Multivariable Results from Multilevel Mixed Effects Logistic Regression

Level and Variable	Null Model			Final Patient Model			Final PT Model			Final Combined Model		
	OR	SE	p	OR	SE	p	OR	SE	p	OR	SE	p
Intercept	0.50	0.05	0.00	0.38	0.05	0.00	0.73	0.13	0.09	0.55	0.12	0.01
Level 1 - Patient (N = 2,642)												
Oswestry Score (Group Mean Centered)				1.03	0.00	0.00				1.03	0.00	0.00
Pain Score (Group Mean Centered)				1.06	0.02	0.02				1.06	0.02	0.02
High Fear Aviodance Beliefs (Y/N)				1.35	0.13	0.00				1.34	0.13	0.00
Insurance Type				1.04	0.02	0.02				1.04	0.02	0.02
Level 2 - Physical Therapist (N = 112)												
Age (15 Year Bands)							0.76	0.12	0.09	0.75	0.13	0.09
Clinic Region							0.89	0.06	0.10	0.90	0.06	0.13
Variance	0.75			0.89			0.70			0.83		
Model Deviance	3273.72			3077.76			3266.94			3071.64		
		95% CI										
Interclass Correlation	0.19	0.13	0.26									

OR = Odds Ratio; SE = Standard Error; PT = Physical Therapist; CI = Confidence Interval
Independent variables retained in the final models if the p-value ≤ 0.15

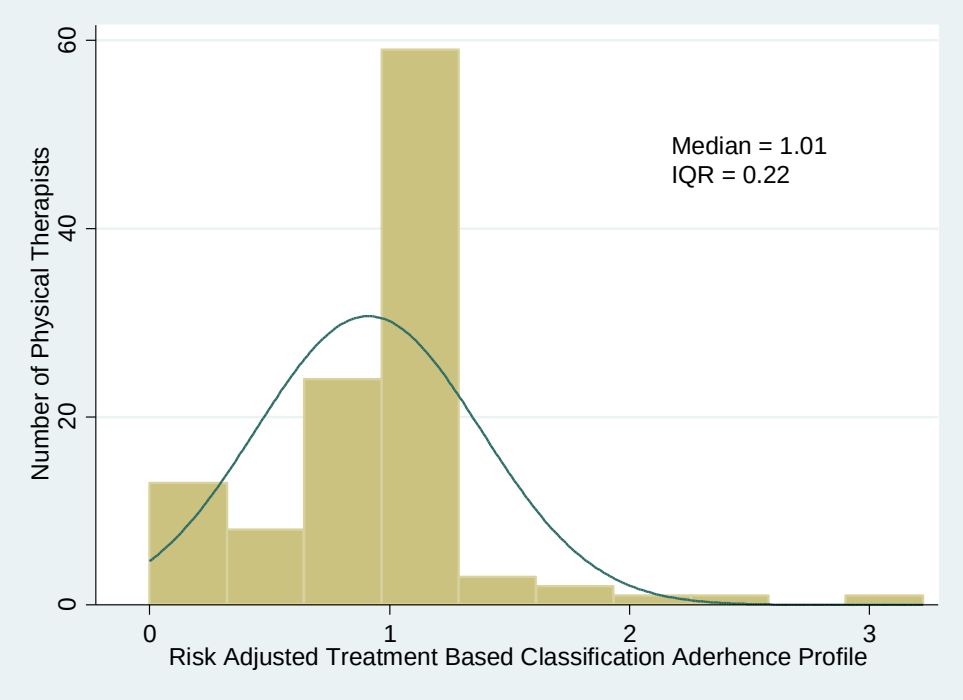


Figure 3. Distribution of the Risk Adjusted TBC Adherence Profiles

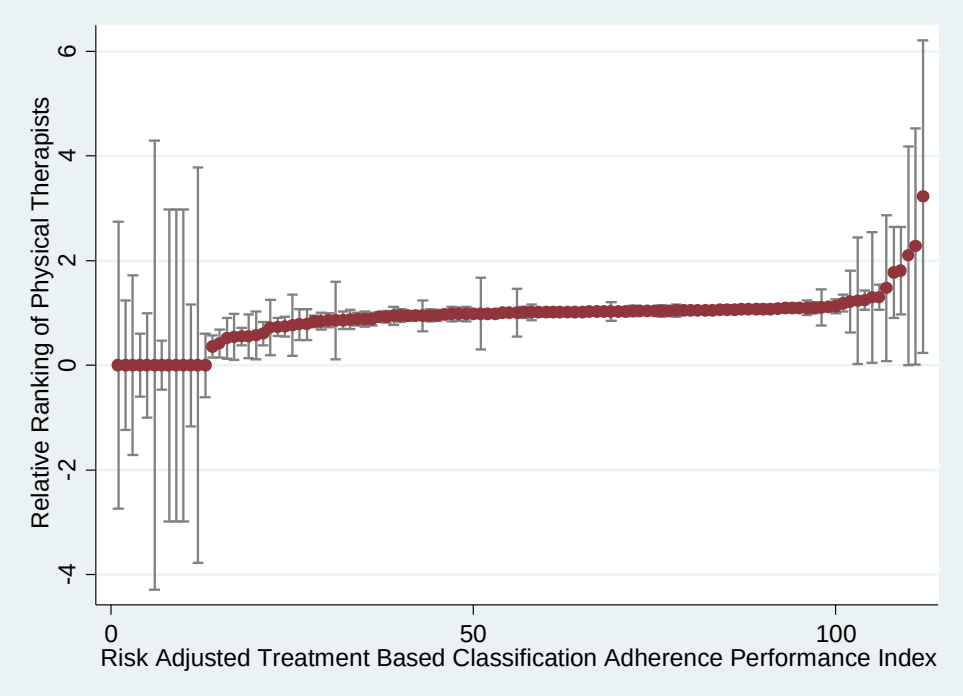


Figure 4. Relative Ranking of Physical Therapists According to the Risk Adjusted TBC Adherence Profiles with 95% Confidence Intervals

2.2.2 Identifying Determinants of Adherence to Guideline Based Care

The second step of the analysis was designed to capture data from physical therapists about factors that have been shown to be associated with the guideline adherent LBP management specifically, or the implementation of evidence based interventions more generally. These factors are depicted within the theoretical framework in Figure 1. An online survey was conducted between June 18, 2013 and July 22, 2013. The survey was administered electronically using Survey Monkey.

2.2.2.1 Participants and Recruitment

The survey was open to all full- or part-time outpatient physical therapists employed by CRS. The project and the Principal Investigator were introduced to the organization's physical therapists via an e-mail communication from the Vice President of Compliance and Quality. The communication outlined the broad goals of the project and indicated that the PI would contact each of them independently. The overview also stressed the fact that all responses would be kept confidential and that no personal identifying information would be shared with any members of the CRS management or staff.

One week following the initial communication the PI sent each physical therapist a personalized e-mail through the Survey Monkey platform providing detailed information about the study procedures. Again, to encourage honest responses they were assured confidentiality. The e-mail contained a link they could follow to access the survey should they choose to participate. The survey was estimated to take 50-60 minutes to complete; however, they were not required to complete the entire survey in one sitting. They were offered a $50 debit card as a

token of appreciation for their time. Weekly e-mail reminders were sent to all partial and non-responders until the survey period expired.

2.2.2.2 Physical Therapist Survey

The physical therapist survey was a 256-item composite of several validated instruments designed to explore important implementation constructs within the domains of the CFIR. The individual instruments were selected based on our preliminary work with the CRS, previous literature showing the importance of a construct on evidence based management of LBP, or literature suggesting the importance of the construct within the field of implementation science. We explored three of the five CFIR domains: 1) personal and professional characteristics of the physical therapist, 2) the acceptability of the Treatment Based Classification guidelines; and Organizational factors.

2.2.2.3 Personal and Professional Characteristics

Personal demographic characteristics included age, gender, race, and ethnicity. The therapists were also queried about their personal history of LBP, their number of previous episodes, and how they self-manage their pain. In addition we used the following instruments. (Appendix C)

The Intolerance for Uncertainty Scale (IUS) is a 12-item scale that measures a dispositional human characteristic stemming from negative beliefs about uncertainty and its future implications.[94,140-142] (Appendix E) The IUS was developed in 1994 and has become the standard measure for this construct.[142,143] Responses are rated on a 5-point Likert scale ranging from "Entirely characteristic or me" to "Not at all characteristic of me." Two subscales have been identified: the "Desire for Predictability" and "Uncertainty Paralysis."[140,142] Internal

consistency is excellent the total scale (α=0.91) as well as each subscale (α=0.85).[140,142] Factor, convergent, discriminant and criterion-related validity have been established.[94,140-142]

The Resistance to Change Scale (RCS) is a 17-item instrument designed to measure individual differences in the dispositional tendency to resist change.[144,145] (Appendix F) Responses are scored on a six-point Likert scale that ranges from "Strongly Agree" to Strongly Disagree."[144] There are four subscales: 1) Routine seeking (5 items), 2) Emotional reaction (4 items), Short-term focus (4 items), and 4) Cognitive rigidity (4 items). Internal consistency coefficients for the overall measure were 0.87–0.88 and subscale coefficients were 0.75–0.82, 0.71–0.78, 0.71–0.78, and 0.69–0.78 for Routine Seeking, Emotional Reaction, Short Term Focus, and Cognitive Rigidity, respectively.[144] The measure has demonstrated factor, convergent, and discriminant validity.[144]

The CSES is designed to measure a dispositional construct of one's general self-concept or the assumptions people make about themselves.[100-102] (Appendix G) Core self-evaluation is a higher order construct that is composite of four lower level traits: self-esteem, neuroticism (emotional stability), locus of control, and general self-efficacy.[100] The CSES was intended to specifically measure the unitary construct more efficiently than measuring the four traits independently.[100] Twelve items comprise the instrument and responses are captured on a five-point Likert scale that ranges from "Strongly Agree" to Strongly Disagree."[100] Internal consistency reliability is good (α=0.81-0.87). Factor, convergent and discriminant validity has been demonstrated.[100]

The Pain Attitudes and Beliefs Scale for Physical Therapists (PABS-PT) is designed to discriminate between a biomedical and psychosocial orientation to LBP management in physical therapists.[136,137] (Appendix D) The instrument contains 19 items, of which 10 pertain to the

biomedical subscale and 9 to the psychosocial subscale.[136,138] Responses are scored on a six-point Likert scale ranging from "Totally Disagree" to "Totally Agree."[136,138] Internal consistency for the biomedical subscale is good (α=0.77-0.84); however, the internal consistency of the psychosocial subscale is less robust and varies (α=0.54-0.68).[136,138,139] Factor, convergent, and discriminant validity have been demonstrated in physical therapy populations.[90,136,138,139]

2.2.2.4 Treatment Based Classification Characteristics

As stated earlier the Treatment Based Classification guidelines provide evidence-based decision support when managing LBP. There are seven management recommendations: Biobehavioral, Directional Preference, Manual Therapy, Stabilization Exercise, Traction, Stage 2 and Stage 3. To arrive at the appropriate end point for each one these classifications the physical therapist compares patient sign and symptom patterns to specific criteria to arrive at the most appropriate clinical course.

The Ottawa Acceptability of Decisions Rules Instrument (OADRI) was used to assess the criteria used for each classification. (Appendix I) The OADRI is designed to measure the acceptability of clinical decision rules to clinicians.[105] The instrument explores several factors that known to represent barriers to research utilization: 1) Evidence Strength and Quality, 2) Complexity, 3) Relative Advantage, and 4) Adaptability. [105] There are 12 items and responses are captured on a six-point scale ranging from "Strongly Disagree" to "Strongly Agree," or the provider may also chose "No Opinion/Don't Know." This last response allows the instrument to be used with respondents that are both unfamiliar and well-versed in the decisions rules.[105] This is accomplished by presenting the specific decision rules to the respondent in conjunction with the survey. This administration strategy allowed each of the seven individual components of the

larger TBC to be assessed separately. Internal consistency is excellent (α=0.78-0.86) and the instrument has shown good convergent and discriminant validity.[105]

2.2.2.5 Organizational Characteristics

The Alberta Context Tool (ACT) is designed to measure individual perceptions of organizational context in complex health care settings and provide valid and reliable reporting at the individual, clinic, or broader organizational level.[83,146] (Appendix H) The ACT is a 56-item survey which explores 10 domains of organizational context: 1) Leadership, 2) Culture, 3) Evaluation, 4) Social Capital, 5) Informal Interactions, 6) Formal Interactions, 7) Structural And Electronic Resources, 8) Organizational Slack-Staff, 9) Organizational Slack-Space, 10) Organizational Slack-Time. [146] The number of items per domain ranges from 6-11 and responses are captured using 5-point Likert/frequency scales. Internal consistence of the ACT subscales is acceptable for the majority of the domains with the exception of Formal Interactions, Structural and Electronic Resources, and Organizational Slack-Space.[83,146-148] (Table 3) Factor and discriminant validity have been demonstrated in multiple healthcare provider populations and settings.[83,146-148]

2.2.2.6 Dependent Variable

The dependent variable for the main analysis was the TBC Adherence Performance Profile. The derivation of this variable was described in detail previously.

2.2.2.7 Independent Variables

Physical therapists' personal characteristics included a three level categorical age variable (25-39 years, 40-54 years, 55-70 years), a dichotomous gender variable, and a dichotomous race variable (White, Other). A physical therapists' personal history of LBP was a dichotomous

variable and there was a four-level categorical value which quantified the number of episodes (none, 1-3, 4-9, 10+). There were continuous measures for the Intolerance of Uncertainty scale (response range 1–5, total score range 12–60) as well as the subscales Desire for Predictability (response range 1–5, total score range 7–35) and Uncertainty Paralysis (response range 1–5, total score range 5–25). There were also continuous measures for the Resistance to Change scale as well as the subscales Routine Seeking, Emotional Reaction, Short-term Focus, and Cognitive Rigidity. All had a response range and mean score range of 1–6. The last personal characteristic was a continuous measure for the Core Self-Evaluations Scale (response range 1–5, mean score range 1–5).

Physical therapists' professional characteristics included a three level categorical variable indicating their entry level professional degree as Bachelors / Certificate, Masters, or Doctoral. There were dichotomous indicators identifying University of Pittsburgh graduates and those with professional certifications. We also had continuous measures of their years in practice, years with the CRS and annual LBP patient volume. There were continuous measures for the two PABS-PT subscales Biomedical Orientation (response range 1–6, total score range 10–60) and Psychosocial Orientation (response range 1–6, total score range 9–54).

Characteristics of the TBC were continuous measures from the OADRI for each TBC decision rule: Acceptability of the Biobehavioral Rule, Acceptability of the Stage 1 Rule, Acceptability of the Stage 2 Rule, Acceptability of the Stage 3 Rule, Acceptability of the Directional Preference Rule, Acceptability of the Manual Therapy Rule, Acceptability of the Stabilization Exercise Rule, and Acceptability of the Traction Rule. All had a response range and mean score range of 1–6.

Organizational characteristics a count of the number of physical therapists as a proxy for clinic size. There were also continuous measures for each component of the ACT: Leadership (response range 1–5, mean score range 1–5), Culture (response range 1–5, mean score range 1–5), Feedback (response range 1–5, mean score range 1–5), Formal Interactions (response range 0–1, total score range 0–4), Informal Interactions (response range 0–1, total score range 0–10), Connections among Colleagues (response range 1–5, mean score range 1–5), Structural & Electronic Resources (response range 0–1, total score range 0–10), Staffing (response range 1–5, mean score range 1–5), Space (response range 1–5, mean score range 1–5), and Time to Deliver Quality Care (response range 1–5, mean score range 1–5).

The environment characteristic was a percentage of each therapists LBP patient volume that was covered under a bundled payment reimbursement.

2.2.2.8 Data Analysis

Stata Release 14.0 (College Station, Texas 77845 USA) was used for all analyses. Descriptive statistics were calculated for the characteristics at each CFIR domain; personal and professional physical therapist, TBC (i.e., innovation), Organizational and Environmental characteristics. A univariate analysis was performed to screen each independent variable for association with the Performance Index. If the p-value for an independent variable was < 0.15 it was included in the multivariable analysis.

Following the univariate analysis a generalized linear model (GLM) using the identity link and Gaussian family was fit including all 2 x 2 interactions. In light of the positively skewed dependent variable, the GLM was preferred as it relaxes the assumption of constant variance of the error terms (i.e., homoscedasticity). This means the dependent variable does not need to be

transformed when using GLM. This is a major advantage because it avoids retransformation bias and facilitates interpretation of model results. [159] However, GLM does require the appropriate link and a family to be confirmed post regression. The link characterizes how the covariates are related to the mean of the dependent variable on its original scale. The family specifies the distribution that reflects the mean-variance relationship. The Gaussian family and identity link were used as a starting point given the continuous dependent variable. [159] Verification of the Gaussian family was established using the Modified Park Test ($\beta = 0.36$, $p = 0.48$) post GLM estimation.[160] The identity link was verified using the approach recommended by Hardin and Hilbe. Repeated models (GLM) were fit testing the Power link function in increments of 0.1 across the range of 0.0 – 1.1. For these data, the identity link, (i.e., Power link 1.0) was confirmed as the appropriate link as it demonstrated the lowest Akaike information criterion (AIC) and Bayesian information criterion (BIC) statistics as well as the largest log likelihood. [159]

With model specification complete a series of models were fit using a forced backward stepwise elimination. Beginning with the full model, which included all 2 x 2 interaction terms, variables were removed one at a time if the p-value exceeded 0.15 beginning with the interaction variable that had the highest p-value. This process was then repeated until all remaining variables had a p-value < 0.15.

2.2.2.9 Results

A total of 189 physical therapists were invited to take the survey and 151 (79.9%) responded. Of the 151 providers that responded 112 (74.2%) had at least one low back pain patient during the time period of interest and were included in the analysis.

Personal Characteristics of Physical Therapists

The personal characteristics of the physical therapist are described in detail in Table 8. The physical therapists included in the study were mostly female (56.3%), white (94.6%) and between the ages of 25 – 39 years (64.3%). Approximately 74% had a personal history of LBP, of those 54.5% had experienced 1-3 past episodes, 8.9% had experienced 4-9 past episodes, and 10.7% had experienced 10 or more. The mean total Intolerance for Uncertainty score was 22.9 (SD = 6.3). The subscale scores for the Intolerance for Uncertainty instrument showed a mean of 15.5 for the Desire for Predictability Subscale (SD = 4.) and 7.4 for the Uncertainty Paralysis Subscale (SD = 2.7). The mean total Resistance to Change score was 2.9 (SD = 0.6). The subscale scores for the Resistance to Change instrument showed a mean of 2.8 for the Routine Seeking Subscale (SD = 0.7), 3.1 for the Emotional Reaction Subscale (SD = 0.9), 2.4 for the Short-term Focus Subscale (SD = 0.8), and 3.5 for the Cognitive Rigidity Subscale (SD = 0.7). The mean Core Self-evaluations Scale score was 4.0 (SD = 0.4).

Professional Characteristics of Physical Therapists

The professional characteristics of the physical therapist are described in detail in Table 8. In this sample the entry level professional degree was Bachelors / Certificate for 29.5%, Masters for 26.8% and Doctoral for 43.8% of the physical therapists. A total of 40.2% had obtained their professional degree at the University of Pittsburgh. They averaged 12.8 years in physical therapy practice and were employed by CRS a mean of 7.1 years. Over 36% have obtained a professional certification. The mean LBP patient volume was 23.6 (SD = 16.5) annually. The mean Biomedical Orientation score was 32.7 (SD = 6.1) and the mean Psychosocial Orientation score was 33.6 (SD = 3.7).

Treatment Based Classification Characteristics

The physical therapists' rating of the acceptability of the TBC classification rules are described in detail in Table 9. The mean score and standard deviation for each rule are as follows: Biobehavioral (4.5, 0.8), Stage 1 (4.5, 0.8), Stage 2 (4.5, 0.8), Stage 3 (4.4, 0.8), Directional Preference (4.9, 0.8), Manual Therapy (4.6, 0.8), Stabilization Exercise (4.7, 0.8), and Traction (4.7, 0.8).

Organizational and Environment Characteristics

The organizational and environmental characteristics are described in detail in Table 9. The mean number of physical therapists per clinic was 2.4 (range of 1 to 23). The mean score and standard deviation for each component of the ACT are as follows: Leadership (4.0, 0.7), Culture (4.1, 0.6), Feedback (3.2, 0.8), Formal Interactions (1.7, 0.8), Informal Interactions (3.8, 1.8), Connections among Colleagues (4.0, 0.6), Structural & Electronic Resources (4.0, 1.8), Staffing (3.7, 1.0), Space (3.1, 1.0), and Time to Deliver Quality Care (3.1, 0.7). The lone environment variable was the mean percentage of LBP patients covered by a bundled payment which was 49.4%.

Results from the Univariate Linear Regression Analysis

The results of the univariate analysis are presented in Table 10. There were a total 5 variables that met the screening criteria (p-value < 0.15) for inclusion in the multivariable analysis. Three of these variables were related to characteristics the physical therapists. The first was the psychological trait Uncertainty Paralysis which was negatively associated ($\beta = -0.040$, $p = 0.02$) with the Performance Index. There were two profession characteristics that were positively associated with the Performance Index. These were Professional Certification ($\beta = 0.207$, $p =$

0.03) and LBP Patient Volume ($\beta = 0.005$, $p = 0.14$), though the later was not statistically significant. There were also two organizational factors that were positively associated the Performance Index. Connections among Colleagues was not significant ($\beta = 0.162$, $p = 0.11$); however, Time to Deliver Quality Care was significant ($\beta = 0.151$, $p = 0.05$). Interestingly, none of the variables exploring the acceptability of the TBC decision rules showed a strong enough univariate association with the Performance Index to be included in the multivariable analysis

Results from the Multivariable Linear Regression with Interaction Effects

The results of the initial and final GLMs including both interaction and main effects, are present in Table 11. Prior to arriving at the final model four interaction variables were removed sequentially in the following order: LBP Patient Volume by Connections among Colleagues (p=0.61), Uncertainty Paralysis by Connections among Colleagues (p=0.57), Uncertainty Paralysis by Time to Deliver Quality Care (p=0.42), and Connections among Colleagues by Time to Deliver Quality Care (p=0.26).

In the final model there were significant five interaction effects. Three of these were cross-domain interactions. The first was an interaction between two personal/professional characteristics of the physical therapist; Uncertainty Paralysis and Professional Certification ($\beta = -0.058$, $p < 0.05$). As demonstrated in Figure 5 the level of Uncertainty Paralysis reported by providers without Professional Certification did not have a significant effect on their performance. Conversely, the level of Uncertainty Paralysis for providers with a Professional Certification does significantly effect performance. In this group providers with low Uncertainty Paralysis perform above average while those with high Uncertainty Paralysis perform significantly worse.

There was also an interaction effect between two professional physical therapist characteristics, LBP Patient Volume and Professional Certifications ($\beta = -0.024$, $p < 0.00$), as seen in Figure 6. For high volume providers Professional Certifications do not significantly alter performance. However, for low volume providers, those with Professional Certifications perform significantly better than those without Professional Certifications.

The three significant interactions that crossed domains of the CFIR involved professional and organizational factors. The first interaction was between Professional Certifications and Time to Deliver Quality Care ($\beta = 0.254$, $p = 0.03$). Again, the performance of providers without Professional Certifications does not significantly change based on their perception of the time available to deliver quality care. (Figure 7) However, for those providers with Professional Certifications performance is significantly improved when they report more Time to Deliver Quality Care. Professional Certifications also interacts with another organizational factor, Connections with Colleagues ($\beta = 0.361$, $p = 0.01$). Once again a similar pattern emerges. Performance significantly improves for providers with Professional Certifications as the strength of their organizational Connections with Colleagues increases, while there is not a significant effect for this construct on those without Professional Certifications. (Figure 8)

Finally, there is an additional interaction between LBP patient volume, a professional characteristic, and the organizational construct of Time to Deliver Quality Care ($\beta = -0.007$, $p = 0.02$). In this instance Time to Deliver Quality Care does not significantly alter the performance of high volume providers. However, for low volume providers performance significantly improves as Time to Deliver Quality Care increases. (Figure 9)

2.2.2.10 Discussion

The results of the analysis provide support for the CFIR globally, and our a priori hypotheses more specifically. The CFIR identifies five domains that can influence the implementation of an evidence-based intervention. Furthermore, there is growing recognition that factors in each domain influence or interact with one another. Understanding which factors, within and across domains, influence the use of evidence based interventions is a central question within the field of implementation science. In this study four of the CFIR domains were investigated and we found interaction effects across two of the domains: individual characteristics and organizational characteristics. Moreover, within the individual characteristics domain we identified both personal and professional factors that appear to have differential effects on performance.

The CFIR is not a prescriptive model. As a result, we undertook an exploratory analysis to identify constructs within each domain that could influence the use of research evidence within the context of the CRS' LBP quality initiative. We used our previous work and research evidence to carefully choose each construct. It was our a priori hypothesis that individual and organization characteristics would be associated with Performance. We also hypothesized that characteristics of the evidence based intervention, the Treatment Based Classification, would not be associated with Performance. The univariate analyses support these hypotheses.

We also hypothesized that there would be interactions between and across CFIR domains. Again, this hypothesis is supported by our research findings. Our results show that a providers' tendencies to hesitate in the face of uncertainty (i.e., Uncertainty Paralysis), which is considered a stable personality trait, can negatively affect performance within the subgroup of therapists with professional certifications. Interestingly, previous work on clinical-decision making within physical therapy found a higher intolerance for uncertainty influenced evidence-

based activity and return to work recommendations in providers with a high biomedical orientation.[93] While we did not find an association with biomedical orientation it does appear that an intolerance for uncertainty may be a factor in clinical decision-making.

Conversely, we found that having any type of professional certification appears to improve performance when certain organizational factors are optimized. For example, having stronger connections with colleagues, where providers feel free to share information with peers and supervisors about patient care, improves performance. Similarly, performance is improved in this group when there is ample time to do something extra for patients, look something up, or gain new clinical knowledge. Intuitively one would expect providers who go on to receive additional professional training to be better performers; however, our results suggest that it may be negatively or positively influenced by other personal and organizational factors.

We also found that the performance of low volume providers improves as a result of certain professional and organizational factors. When low volume providers have professional certifications or they perceive they have ample time to do something extra for patients, look something up, or gain new clinical knowledge, performance appears to be significantly better. It stands to reason that those with more training or one who has more time would be positively impacted when presented with a clinical condition they don't often treat.

One finding from our study that may seem counterintuitive is the fact that physical therapists' views or acceptance of the TBC guidelines was not associated with performance. However, this finding is consistent with emerging evidence. For example, Rycroft-Malone and colleagues found that strong, compelling, and broadly accepted research evidence was not sufficient to successfully translate that evidence into practice. They concluded that contextual factors can have a greater impact on implementation success.[64]

One of the major strengths of this study was our ability to directly measure TBC guideline adherence. In many implementation studies investigators must use proxy measures or clinical vignettes as the research outcome. This was not the case in our study as we were able to ascertain provider behavior. Another strength of the study was the size of the dataset. We had ample observations to use multi-level mixed effects models to create performance profiles to which allows better provider-to-provider comparisons. One limitation of our study was the inability to match risk adjusted performance profiles to all 151 providers who completed the survey. However, when we compared the acceptance of the TBC along with personal, professional, and organizational characteristics of those with and without performance profiles we found only minor differences. The groups that did not have performance profiles were younger and rated the acceptability of the Directional Preference and Traction rule slightly lower than those with performance profiles. While this is undesirable it is unlikely that this would substantially bias our results.

The implementation of evidence-based practices is difficult and takes effort. This study has shown there are many factors that can influence provider behavior. We found interactions between personal-professional characteristics, professional-professional characteristics, and professional-organizational characteristics. In each of these circumstances our results suggest that for certain subgroups of providers, individual or organizational characteristics can mean the difference between above average or below average performance. Systematic reviews have shown that tailored, multicomponent implementation interventions are more effective at producing sustainable behavior change.[16] In addition, there is a recognition that interventions need to take a systems perspective so that factors across the CFIR domains are considered and addressed.[19] This exploratory investigation has highlighted potentially mutable factors that are

affecting adherence to the TBC guidelines. In the next phase of this research we will conduct a qualitative investigation to gain further insight into factors affecting guideline adherence with the goal of developing a tailored, multicomponent intervention to improve performance.

Table 8. Personal and Professional Characteristics of Physical Therapist

	Frequency	Percentage	Mean	SD	Median
Personal Charcteristics					
Age					
25 – 39 Years	72	64.3%			
40 – 54 Years	31	27.7%			
55 – 70 Years	9	8.0%			
Gender					
Female	63	56.3%			
Male	49	43.7%			
Race					
White	106	94.6%			
All Others	6	5.4%			
Personal History of LBP					
No	29	25.9%			
Yes	83	74.1%			
Number of Previous Episodes of LBP					
None	29	25.9%			
1 - 3 Episodes	61	54.5%			
4 - 9 Episodes	10	8.9%			
10+ Episodes	12	10.7%			
Intolerance of Uncertainty			22.9	6.3	21.0
Desire for Predictability Subscale			15.5	4.1	15.0
Uncertainty Paralysis Subscale			7.4	2.7	6.5
Resistance to Change			2.9	0.6	2.9
Routine Seeking Subscale			2.8	0.7	2.8
Emotional Reaction Subscale			3.1	0.9	3.3
Short-term Focus Subscale			2.4	0.8	2.3
Cognitive Rigidity Subscale			3.5	0.7	3.5
Core Self-evaluations			4.0	0.4	4.0
Professional Charcteristics					
Entry Level Physical Therapy Degree					
Bachelors / Certificate	33	29.5%			
Masters	30	26.8%			
Doctoral (DPT)	49	43.8%			
University of Pittsburgh Graduate					
No	67	59.8%			
Yes	45	40.2%			
Professional Certification					
No	71	63.4%			
Yes	41	36.6%			
Years with CRS			7.1	6.2	4.6
Years in Practice			12.8	10.5	10.5
LBP Patient Volume			23.6	16.5	24.0
Biomedical Orientation			32.7	6.1	33.0
Psychsocial Orientation			33.6	3.7	33.0

Table 9. Treatment Based Classification, Organizational, & Environmental Characteristics

	Mean	SD	Median
Treatment Based Classification Characterisitcs			
Acceptability of the Biobehavioral Rule	4.5	0.8	4.6
Acceptability of the Stage 1 Rule	4.5	0.8	4.6
Acceptability of the Stage 2 Rule	4.5	0.8	4.5
Acceptability of the Stage 3 Rule	4.4	0.8	4.4
Acceptability of the Directional Preference Rule	4.9	0.8	5.0
Acceptability of the Manual Therapy Rule	4.6	0.8	4.7
Acceptability of the Stabilization Exercise Rule	4.7	0.8	4.8
Acceptability of the Traction Rule	4.7	0.8	4.8
Organizational Chacteristics			
Number of Therapists	2.4	2.6	2.0
Leadership	4.0	0.7	4.0
Culture	4.1	0.6	4.1
Feedback	3.2	0.8	3.3
Formal Interactions	1.7	0.8	1.5
Informal Interactions	3.8	1.8	3.5
Connections among Colleagues	4.0	0.6	4.0
Structural & Electronic Resources	4.0	1.8	3.8
Staffing	3.7	1.0	4.0
Space	3.1	1.0	3.2
Time to Deliver Quality Care	3.1	0.7	3.0
Environmental Chacteristics			
LBP Bundled Payment	49.4%	21.8%	50.0%

Table 10. Univariate Results from Linear Regression

Variable (n = 112)	Univariate Analysis		
	β	SE	p
Personal Charcteristics			
Personal History of LBP	0.11	0.11	0.31
Number of Previous Episodes of LBP	-0.04	0.05	0.44
Intolerance of Uncertainty	-0.01	0.01	0.30
Desire for Predictability Subscale	0.00	0.01	0.88
Uncertainty Paralysis Subscale[1,2]	-0.05	0.02	0.02
Resistance to Change	0.04	0.09	0.68
Routine Seeking Subscale	0.00	0.07	0.98
Emotional Reaction Subscale	-0.02	0.05	0.73
Short-term Focus Subscale	0.08	0.07	0.23
Cognitive Rigidity Subscale	0.05	0.07	0.50
Core Self-Evalutions	0.06	0.12	0.62
Professional Charcteristics			
Entry Level Physical Therapy Degree	0.04	0.06	0.49
University of Pittsburgh Graduate	0.05	0.10	0.60
Professional Certification[1,2]	0.21	0.10	0.03
Years with CRS	0.00	0.01	0.95
Years in Practice	0.00	0.00	0.45
LBP Patient Volume[2]	0.00	0.00	0.14
Biomedical Orientation	-0.01	0.01	0.50
Psychsocial Orientation	-0.01	0.01	0.41
Treatment Based Classification Characterisitcs			
Acceptability of the Biobehavioral Rule	-0.03	0.06	0.60
Acceptability of the Stage 1 Rule	0.02	0.06	0.76
Acceptability of the Stage 2 Rule	0.00	0.06	0.99
Acceptability of the Stage 3 Rule	-0.01	0.06	0.90
Acceptability of the Directional Preference Rule	0.08	0.07	0.21
Acceptability of the Manual Therapy Rule	0.01	0.06	0.87
Acceptability of the Stabilization Exercise Rule	-0.06	0.06	0.27
Acceptability of the Traction Rule	-0.03	0.06	0.62
Organizational Chacteristics			
Number of Therapists	-0.01	0.01	0.17
Leadership	-0.02	0.07	0.77
Culture	0.08	0.09	0.38
Feedback	0.05	0.07	0.47
Formal Interactions	0.00	0.06	0.99
Infromal Interactions	-0.01	0.03	0.64
Connections among Colleagues[2]	0.16	0.10	0.11
Structural & Electronic Resources	0.02	0.03	0.43
Staffing	0.00	0.05	0.93
Space	-0.03	0.05	0.59
Time to Deliver Quality Care[1,2]	0.15	0.08	0.05
Environmental Chacteristics			
LBP Bundled Payment	-0.17	0.23	0.45

SE = Standard Error; LBP = Low Back Pain

[1]Independent variable is significant and $\alpha = 0.05$

[2]Independent variable included in multivariable analyses if $p \leq 0.15$

Table 11. Multivariable Results from Linear Regression with Interaction Effects

	Initial Model			Final Model		
Variable (n = 112)	**β**	**SE**	**p**	**β**	**SE**	**p**
Intercept	0.26	1.49	0.86	0.72	0.49	0.14
Interaction Effects						
Professional Certification * LBP Patient Volume[1,2]	0.02	0.01	0.00	-0.02	0.01	0.00
Professional Certification * Uncertainty Paralysis[1,2]	-0.07	0.03	0.03	-0.06	0.03	0.05
Professional Certification * Connections among Colleagues[1,2]	0.32	0.17	0.06	0.36	0.15	0.01
Professional Certification * Time to Deliever Quality Care[1,2]	0.29	0.12	0.02	0.25	0.12	0.03
LBP Patient Volume * Uncertainty Paralysis[2]	0.00	0.00	0.48	0.00	0.00	0.10
LBP Patient Volume * Connections among Colleagues	0.00	0.01	0.61			
LBP Patient Volume * Time to Deliever Quality Care[1,2]	0.00	0.00	0.44	-0.01	0.00	0.02
Uncertainty Paralysis * Connections among Colleagues	0.02	0.03	0.54			
Uncertainty Paralysis * Time to Deliever Quality Care	0.02	0.03	0.40			
Connections among Colleagues * Time to Deliever Quality Care	-0.12	0.11	0.27			
Main Effects						
Professional Certification	-0.94	0.66	0.16	-1.03	0.61	0.09
LBP Patient Volume	0.03	0.02	0.27	0.03	0.01	0.06
Uncertainty Paralysis Subscale	-0.17	0.14	0.24	-0.04	0.03	0.18
Connections among Colleagues	0.21	0.40	0.60	-0.08	0.10	0.41
Time to Deliever Quality Care	0.38	0.44	0.39	0.13	0.11	0.23
Model Fit Statistics						
Deviance	91.74			94.62		
AIC	1.10			1.06		
BIC	-438.10			-456.59		

SE = Standard Error; LBP = Low Back Pain

[1]Interaction variable significant in the final model at $\alpha = 0.05$

[2]Interaction variable retained in the final model if $p \leq 0.15$

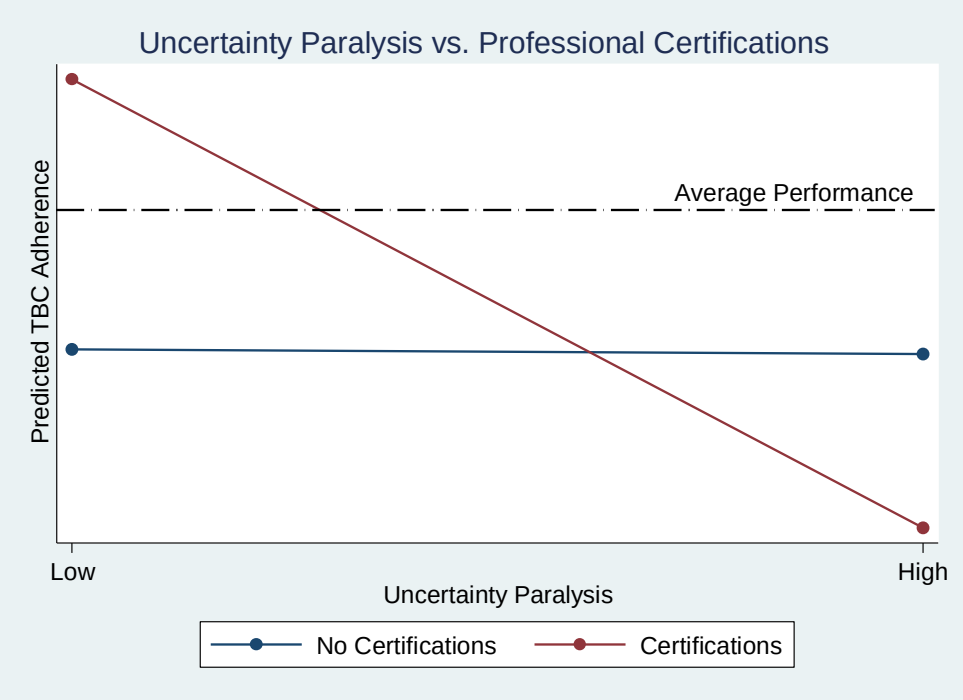


Figure 5. Effect of Uncertainty Paralysis and Professional Certifications and Predicted Performance

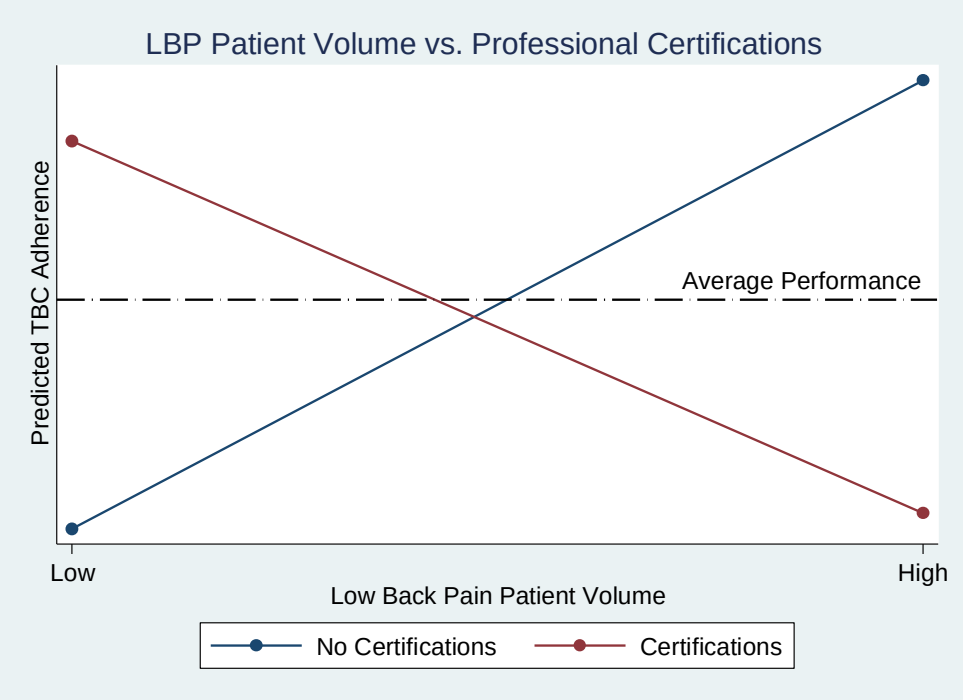


Figure 6. Effect of Low Back Pain Volume and Professional Certifications and Predicted Performance

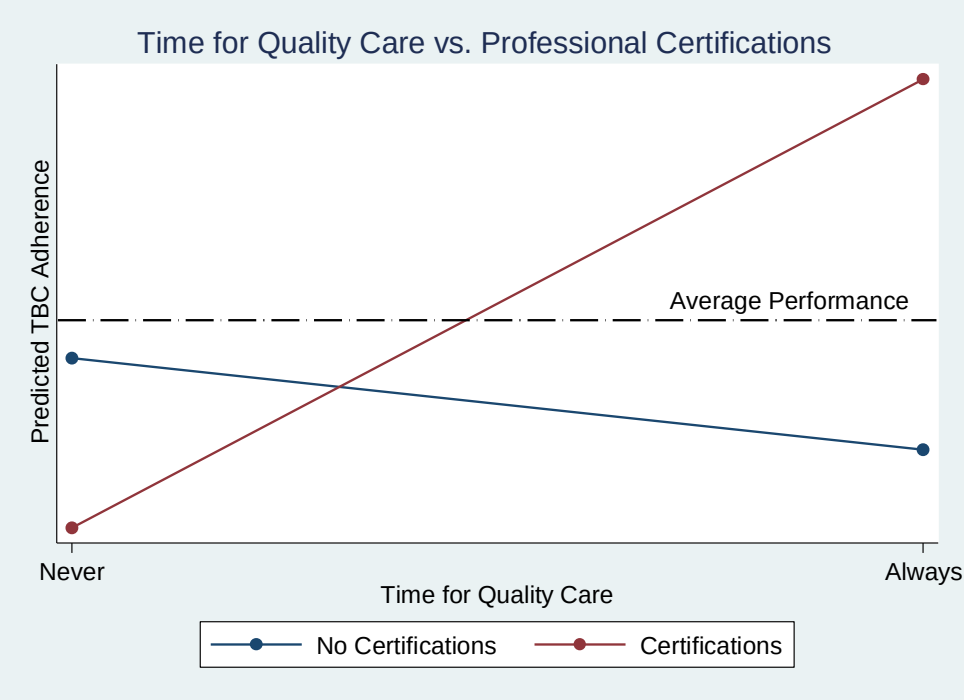


Figure 7. Effect of Time for Quality Care and Professional Certifications and Predicted Performance

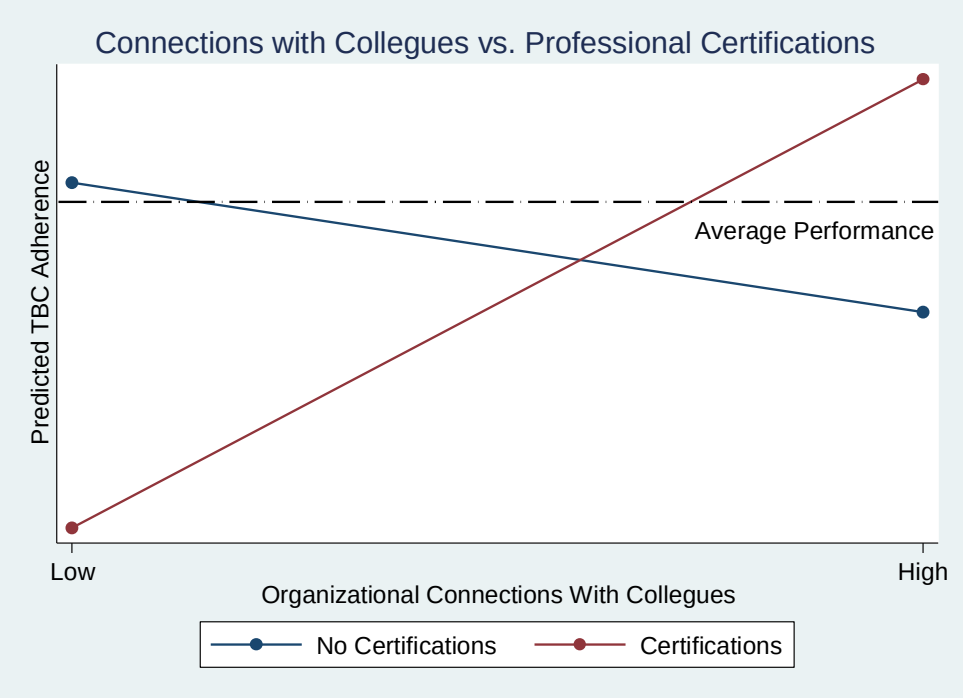


Figure 8. Effect of Colleagues and Professional Certifications and Predicted Performance

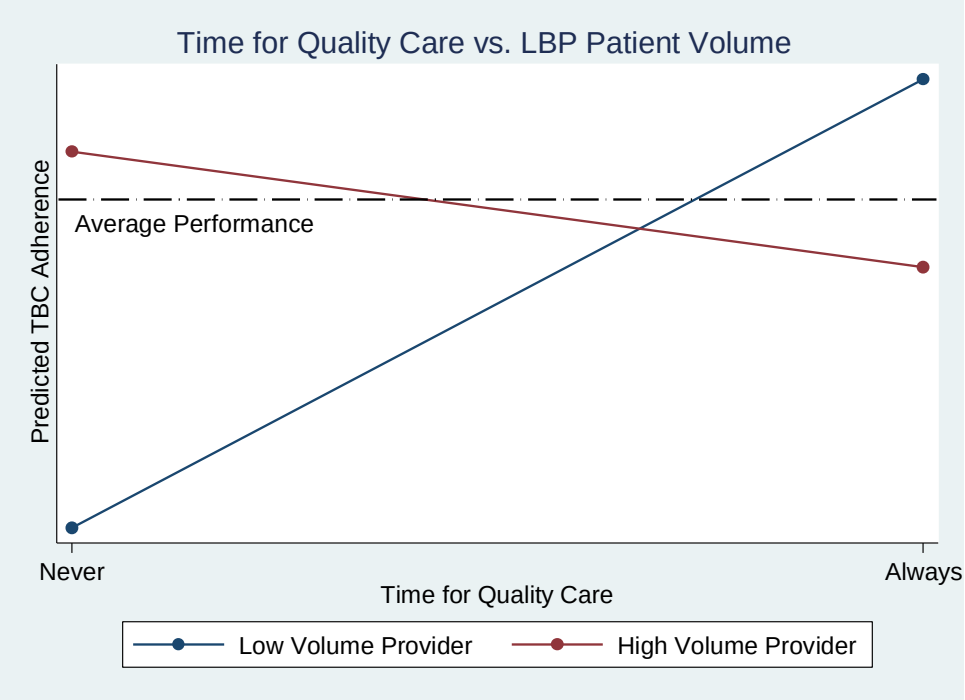


Figure 9. Effect of Time for Quality Care and Low Back Pain Volume on Predicted Performance

3.0 CAPTURING PHYSICAL THERAPISTS' OPIONIONS ON THE USE OF LOW BACK PAIN GUIDELINES USING SEMISTRUCTED INTERVIEWS

3.1 INTRODUCTION

Implementation is difficult and can be confounded by many factors. However, unlike in traditional explanatory research both context and "confounders" lie at the heart of the implementation. Therefore, these factors should not be viewed as extraneous to the study, but instead as an integral part. The multiple interactions that arise in particular settings are the often determinates of successful implementation.[161]

The Consolidated Framework for Implementation Research (CFIR) is a theoretical framework that reflects the complexity of factors that can affect the routine use of evidence based interventions.[65] The CFIR identifies 5 domains and 39 constructs that have been found to influence implementation. The domains and constructs include:

6) Outer setting (e.g., patient needs, peer pressure, external policies & incentives);
7) Characteristics of organization (e.g., leadership, culture, networks & communication;
8) Characteristics of individuals (e.g., knowledge & beliefs, personal attributes);
9) Characteristics of the innovation (e.g., evidentiary strength, complexity); and
10) Implementation process (e.g., planning, opinion leaders, champions)

In this study we are capitalizing on one large outpatient physical therapy organization's multiyear effort to implement evidence based low back pain (LBP) guidelines. The centerpiece of the initiative is the Treatment Based Classification (TBC) guidelines. Unfortunately, guidelines adherence remains suboptimal despite iterative cycles of implementation efforts, the details of which have been published elsewhere.[155] In this study we are using the CFIR to guide a qualitative investigation to explore for barriers and facilitators to adherence with the TBC guidelines.

3.2 METHODS

This study is the second stage of a sequential, mixed methods formative evaluation. In the first stage, quantitative methods were used to explore a wide range of factors that may affect routine use of the TBC guidelines across the CFIR domains. In this stage we used qualitative methods to complement and expand on the first study.[162] To achieve this objective, high and low performing physical therapists were interviewed to gain a deeper understanding of the clinical decision-making processes they use when managing LBP patients. This study was approved as a quality improvement project by the UPMC Institutional Review Board (0001316).

3.2.1 Sample and Recruitment

Purposive, maximum variation sampling was used to recruit physical therapists. High and low performing providers were identified using the TBC adherence profile calculated in the first stage of the study. The total study sample (n=112) was stratified by quartile and an e-mail was

sent to the highest and lowest performing 25% of providers asking for an affirmative response if they were willing to participate in a telephonic interview. We chose to reach out half the sample (56 providers) because we did not expect all providers to be willing to interview. It was our goal to interview at least 30 providers, 15 in each group, and we were able to achieve this target. To encourage honest responses participants were assured confidentiality. The interview was estimated to take approximately 20 minutes and a $25 debit card was offered as a token of appreciation.

3.2.2 Interviews

An interview guide was developed to explore the clinical decision-making processes used by high and low performing providers when managing LBP patients. We included prompts to assess how key assessment and treatment components of the TBC were incorporated in their management strategies. We also included prompts to elicit feedback for improving the TBC, and to ascertain its perceived importance at various organizational levels. Slightly different versions of the interview guide were used for high and low performers. This was done to tailor the questions given the demonstrated difference in TBC adherence between the two groups. (Appendix K)

A panel of TBC clinical experts and a qualitative research expert reviewed and critiqued the guide. We then piloted it by interviewing four CRS physical therapists who were not in the highest or lowest performing groups to ensure clarity of question phrasing. We made minor modifications to the guide after these interviews as well as after interviewing the first high- and low-performing physical therapists. This was done to refine the questions and add prompts that

would facilitate discussion of important constructs. The semi-structured telephonic interviews were conducted by the same individual. All interviews took place between May and June 2016.

3.2.3 Analysis

The interviews were digitally-recorded and transcribed. The qualitative data analysis software package Atlas.ti was used to analyze the transcribed data. A priori coding schemes were developed based on the CFIR. These were used to code the interviews. Additional coding themes that were not designated a priori were developed and used as they became apparent from reading the transcripts. A total of five major coding headings were used assessment, treatment, characteristics of the therapist, characteristics of the innovation (i.e., TBC guidelines), characteristics of the organization. There were also sub-codes under each of these major headings. To enhance reliability each interview was independently coded using this set of codes by two trained research assistants. When the coders identified unique quotations or differed on choice of code, the inconsistencies were discussed with the Principle Investigator and consensus was reached on which coding scheme to use. Once the data were coded, the coded text for each code was printed and reviewed for common themes.

3.3 RESULTS

The physical therapists interviewed were most mostly female (63%). Fifty-seven percent were between 25–39 years, 37% were between 40–54 years, and 6% were between 55–70 years of age. They averaged 14.1 years in physical therapy practice and were employed by CRS a mean of 7.3 years. Sixteen (53%) received their professional training at the University of Pittsburgh

and 37% held at least one secondary professional certification. The characteristics of providers participating in interviews did not differ significantly from those that were not interviewed.

There were six themes that mapped to three of the CFIR domains. Two of the themes were related to the Characteristics of the Innovation (i.e., TBC guidelines). Two themes mapped to the Characteristics of Individuals and two to the Characteristics of the Organization.

Characteristics of the Innovation

Order to the Assessment–the TBC guidelines are designed as an algorithmic decision aid to help clinicians synthesize data collected as part of the patient assessment. Forty-seven percent (47%) of interviewees found this structure valuable. A slightly higher number of low-performing providers reported this beneficial characteristic. Both high- and low-performing providers thought the TBC guidelines brought order to the patient assessment:

> "I think having a system, and having this guidance, and this organized thought process, it's super-beneficial." [P8 High Performer]

> "It's a good general classification system, I think, to help you kind of filter through some of the information that you gather from the patient during the exam. Sometimes it can help you stay a little bit more on track." [P19 Low Performer]

> "Well I think the structure definitely gives you a good framework for evaluating each person…" [P10 High Performer]

> "…it obviously does not make treating low back black and white, but at least it helps you be systematic in the way that you approach it." [P28 Low Performer]

Classification Uncertainty–when following the TBC guidelines the terminal decision the provider must make is to classify patients into one of seven treatment categories. However, there are times when a patient falls into more than one classification simultaneously. This issue with the TBC guidelines was reported by 60% of the providers. Furthermore, equal numbers of high- and low-performing providers report struggling with patients that don't cleanly fit into one of the classification categories:

> "I think in the beginning, it may make it a little harder to guide your treatment, because they're jumping, they may fit into a couple." [P7 High Performer]

> "You know, and sometimes people don't always just fit into one, but they might be, you know, kind of a gray line there a little bit." [P26 Low Performer]

> "They're often fitting into multiple categories..." [P11 High Performer]

> "…but sometimes I find it hard to know what to pick because they'll—the patient will have…be a little bit into two categories." [P25 Low Performer]

> "Well, I would say that some patients don't fit exactly into one category." [P14 High Performer]

Characteristics of Individuals

Confusion over Patient Staging–patient staging is the key link between the patient assessment and the selection of the appropriate treatment classification. During this step in the process the provider determines the therapeutic goal–symptom control, movement control or functional optimization–which directs them to the treatment classifications that are designed to address the

specific therapeutic objective. According to the TBC guidelines this decision is based on the "acuity" or "irritability" of the patient's condition not the duration of complaints (i.e., acute, subacute, chronic). However, 43% of providers indicate a misunderstanding of this fundamental principle.

> "…not everybody fits into the treatment-based classification because of their longstanding chronicity of the back pain." [P2 High Performer]

> "I use it daily, you know, with those types of patients [acute], but I also would say I use, you know, some other factors…" [P26 Low Performer]

> "…the other half of our clinic is the chronic pain patients. So, it's not very—you can't use the classification with them…" [P3 High Performer]

> "I would say probably, honestly, 40% of the time, because, well, let me take that back. I guess when I think of the treatment based classification, I think of more mechanical based symptoms and that will help me guide my treatment and interventions at that point. And I give the initial percentage at 40%, just because I feel like the other 60% are more chronic issues…" [P17 Low Performer]

While there appears to be a high level of confusion on this topic there were some important differences detected between the high- and low-performing providers. More specifically, of the 23 providers that directly commented on patient staging in the interviews, 53% of the high performers indicated an understanding of the staging process that is consistent with the TBC guidelines compared with only 25% of the low performers. Here are two examples from high-performing providers:

"… mainly based on their pain level and their acuity of symptoms. So higher pain levels, where I'm looking for symptom modification…I'll put them into a stage one, and if that's not the primary concern but there's some definite impairments present, put them into a stage two. And if it's more of just return to work, or function, or a sport, or whatever, then put them in a stage three." [P5 High Performer]

"I'll use irritability level. So how easily irritable is that condition, even though they may have it for seven weeks or more, but it's highly irritable, I'll end up, I'll actually treat them more acutely, as acute, than if they were subacute or chronic, just based on symptom duration alone." [P8 High Performer]

Objective Psychosocial Assessment–the TBC guidelines stress the need to identify and address psychosocial risk factors in all patients regardless of their clinical stage. Due to the importance of this step all patients are required to complete a structured, risk assessment tool–Fear Avoidance Beliefs Questionnaire or STarT Back–that assesses this construct prior to seeing the therapist. In the interviews both high- and low-performing providers were asked directly how they evaluate patients' psychosocial status. Overall performance was good, as approximately 83% of interviewees reported using an objective risk assessment tool. However, there were again some differences between the two groups. In the low-performing group 27% did not use the instrument(s) compared to 7% in the high-performing group. Here are three examples:

"Pretty just much with the history…and how they respond…the pain form, and then as they're going through the program how's that changing." [P22 Low Performer]

"Yeah, that's something that I think has been kind of a weak area of mine. It's usually something that, it'll usually be a, I don't usually ask…" [P8 High Performer]

"Overreaction, some of the Waddell signs, like loading through, axial loading, sitting versus supine straight leg raise test." [P17 Low Performer]

Characteristics of the Organization

Strong Senior Leadership Support–both high and low providers were asked how important they thought adherence to the TBC guidelines were to the organization's senior management team. Twenty-nine of the 30 interviewees (97%) indicated that they believed it was a high priority at the top of the organization:

"Very important. They pretty much want us to guide our low back patients through this whole program." [P20 Low Performer]

"Overall, yeah, I would probably say highly important." [P13 High Performer]

Oh, they want us to use it all the time, every time. [P27 Low Performer]

Again, if not 100% close to it. [P6 High Performer]

"I would say 100 percent, that they do expect us to use it." [P22 Low Performer]

Indifferent Supervisor Support–both high and low providers were asked how important they thought the adherence to the TBC guidelines were to their immediate supervisor. In this instance only 47% indicated that they believed it was a high priority to their immediate supervisor. These response were evenly split between the two groups:

"Honestly, I don't think that they would care what system you're using, per se, as long as you're getting good quality outcomes and your patients are satisfied with their treatment." [P5 High Performer]

"I would say more indifferent. I don't think that he would necessarily share the same feelings as myself and some of my other co-workers..." [P28 Low Performer]

"I don't know that I've really discussed it with my supervisor concerning the treatment based classification." [P12 High Performer]

"Probably about less than 50 percent." [P24 Low Performer]

3.4 DISCUSSION

Our analysis found themes across three of the five CFIR domains. Two of the themes are related to the characteristics of the innovation. These were order to the assessment and classification uncertainty. Two themes, patient staging and objective psychosocial assessment, were related to

the characteristics of individuals. The final two themes were strong senior leadership support and indifferent direct supervisor support, which fall under characteristics of the organization.

When considering the themes we found more similarities between high and low performers than differences. This finding was contrary to our a priori assumptions. Both groups of providers felt that the TBC is a valuable framework to help organize the assessment and bring structure to what can be a complicated evaluation. However, a significant barrier to execution of the TBC was the classification uncertainty. Providers repeatedly expressed difficulty in choosing a treatment strategy because many patients do not fit clearly into one category or the other.

The lack of fit is not a new finding. Previous studies using a modified version of the original TBC have found that approximately 25%–40% of patients can have unclear classifications because they don't meet all criteria or they fit multiple classifications simultaneously.[163,164] This characteristic of the TBC can diminish its utility as a decision support tool because in many cases it does not provide the clinician with clear, actionable guidance.[165] Perhaps it would be beneficial if there was a clinical hierarchy or classification prioritization that could help providers reconcile questionable cases.

Another barrier is the providers' confusion regarding *patient staging.* This appears to be especially true for patients that have passed the acute stage of recovery. Among the interviewees there is an explicit misconception that the TBC does not apply to chronic cases. This is true even among some high-performing providers. This misconception is of extreme importance because attempts to classify chronic patients without appropriate staging has been shown to render more than 60% of patients as unclassifiable.[163]

The genesis of this misconception may be at least partially explained by considering the evolution of the TBC. A full treatment of this evolution, from its inception in 1995 through the 2007 and 2015 updates, has been published previously.[166] In the original version of the TBC, patient staging was the keystone linking the patient assessment to appropriate classification and treatment decisions. Before treatment could be selected, the patient was categorized into one of three stages based on the therapeutic objective. It was only after the objective was determined that appropriate treatment could be identified. Importantly, the staging criteria did not consider the duration of the LBP complaint. As pointed out in the 2015 update, "the TBC developers described the staging process to prescribe interventions according to pain intensity and disability status rather than relying on arbitrary definitions of acute, subacute, and chronic." Therefore, staging was a predicate step to proper patient management.[166]

The TBC was updated in 2007. This revised version reflected a considerable amount of research evidence supporting individual components of the TBC.[111,166] However, in retrospect there were two important changes in the 2007 version that may shed light on the difficulty providers are facing when using the TBC guidelines. First, the 2007 version eliminated patient staging.[111] Secondly, the classification/interventions in this update highlighted those that primarily target patients in the acute/subacute stage of recovery (i.e., Stage 1) thereby minimizing the importance of the other stages. As such, it is understandable that providers could view the TBC as applying only to acute LBP patients. The recently published 2015 TBC update attempts to rectify that issue by again incorporating the patient staging as the key step in appropriate classification and treatment selection.[166]

A very high percentage of providers report utilizing the organization's objective instruments, which assess psychosocial risk factors in patients. This assessment is an integral

component of the TBC guidelines. Results from our quantitative analysis show that more than half of patients presented with elevated psychosocial risk scores. However, our quantitative analysis showed a large discrepancy in adherence rates for this component of the classification categories between high and low performing providers. Some differences in the use of the risk tools were detected from the interviews but not enough to fully explain the quantitative results.

Leaders are important to successful implementation. They can encourage innovation, create capacity, and provide the resources necessary for change.[167,168] The role of leadership falls within the CFIR domain Characteristics of the Organizational. Both high and low performers perceive the use of the TBC guidelines as a high priority for the organization's senior management team. Conversely, only 47% of interviewees reported strong support for the TBC guidelines from their immediate supervisor. The impact of this mixed support on TBC adherence is unknown as the responses were equal in both groups, but this certainly warrants further investigation.

Our study points to patient staging and classification uncertainty as important barriers to TBC adherence. The fact that patient staging appears to be poorly understood is of great concern. This component of the TBC guidelines is the link between the patient assessment and appropriate treatment selection. Without proper execution of this piece the utility of the TBC guidelines in everyday practice is greatly diminished. This appears to be a very fruitful area for investigation.

Similarly, the impact of classification uncertainty as a barrier to adherence to the TBC should not be overlooked. Previous work in physical therapy populations has indicated the importance of the degree of tolerance for uncertainty in treatment decisions including the use of evidence based guideline recommendations.[93,96,169] Similar findings have been found in

physician populations. Intolerance for uncertainty has been found to be associated with greater test ordering, higher utilization costs, and a failure to comply with evidence based guidelines.[170,171] It is unlikely that an individual's disposition to uncertainty can be change, however, perhaps the TBC guidelines can be refined to minimize the issue. Therefore, these appear to be two a promising area to address when considering interventions to improve performance.

4.0 STUDY SIGNIFICANCE AND FUTURE DIRECTIONS

The overarching objective of this project was to conduct a formative evaluation of a longstanding quality improvement initiative. This initiative seeks to improve the management of patients with low back pain (LBP) in the outpatient physical therapy setting. The center of this initiative is the Treatment Based Classification (TBC) guidelines. The TBC guidelines were first implemented within the UPMC Centers for Rehab Services (CRS) in 2005. Since that time the organization has used several evidence based implementation strategies in an attempt to increase physical therapists' adherence to the TBC guidelines.[155] Despite these iterative improvement efforts adherence to the TBC guidelines remains suboptimal (~37%). Our aim was to identify potential barriers and facilitators to TBC guideline adherence.

To achieve this objective we conducted a mixed methods investigation, guided by the Consolidated Framework for Implementation Research (CFIR). The CFIR is an explanatory framework that defines five domains that have the potential to influence implementation:

1) the outer setting (i.e. give some examples)
2) the inner setting (i.e., UPMC CRS)
3) characteristics of the clinical innovation (i.e., the TBC guidelines)
4) characteristics of the individual (i.e., physical therapists)
5) implementation processes.

We used a two-stage sequential study design to identify factors that could be influencing TBC adherence. In the first stage we surveyed CRS physical therapists and linked their responses to a risk-adjusted TBC performance index. This allowed us to evaluate a broad range of factors that influence TBC adherence across multiple CFIR domains. In the second stage we conducted semi-structured interviews with high- and low-performing providers to gain a deeper understanding of the barriers and facilitators of their use of the TBC guidelines.

Our results suggest there are two important barriers to TBC guideline adherence, both of which represent an interplay between the characteristics of the clinical innovation (i.e., the TBC guidelines) and characteristics of the individuals (i.e., physical therapists). The first barrier relates to *classification uncertainty.* The strength of the TBC is the ability to classify a patient according to the treatment with the highest probability for success. Classification uncertainty, within this context, occurs because there are patients who do not fit any single treatment classification, or may simultaneously fit into more than one treatment classification. This finding has been reported previously and can occur up to 50% of the time.[163,164] This characteristic of the TBC can diminish its utility as a decision support tool because in many cases it does not provide the clinician with clear, actionable guidance.[165] Both high- and low-performing providers described classification uncertainty as a challenge.

Interestingly, our results indicate that classification uncertainty does not affect all providers in the same way. These findings are consistent with other research showing a provider's intolerance for uncertainty is an important factor in patient management decisions. Previous work with physical therapists and physicians has found that a provider's intolerance for uncertainty impacts their clinical decision-making, including their adherence to evidence-based guidelines.[93,170] In this study we measured this personality trait using the Intolerance for

Uncertainty instrument.[144] Our univariate results showed that providers' scores on the Uncertainty Paralysis subscale were negatively associated with TBC guideline adherence. In other words, as Uncertainty Paralysis scores increased TBC guideline adherence decreased. Furthermore, using a multivariable model we found a differential effect of Uncertainty Paralysis on providers with professional certifications. In this subgroup of providers, adherence levels decreased significantly with rising Uncertainty Paralysis scores. While classification uncertainty may be an issue generally, it appears to have a more profound effect on this subgroup of providers.

A second barrier to TBC adherence appears to be related to physical therapists' poor understanding and/or lack of execution of *patient staging*. Within the context of the TBC, patient staging is the keystone linking assessment findings to correct treatment decisions. According to the TBC guidelines, patients should first be categorized into one of three stages (Stage 1, Stage 2, or Stage 3) based on the "irritability" of their condition, not on how long the condition has been present. As pointed out in the recently published 2015 update, "the TBC developers described the staging process to prescribe interventions according to irritability, pain intensity and disability status rather than relying on arbitrary definitions of acute, subacute, and chronic."[166]

Our provider interviews revealed that many are under the misconception that the TBC guidelines do not apply to–or do not fit–chronic LBP patients. It appears that this misconception is manifest because providers do not know, understand, or agree that patient staging is based on irritability, pain intensity and disability status -- and not simply duration of symptoms. This is important because previous work has shown that as the duration of symptoms increases, patients are less likely to fit the Stage 1 classification.[163] By extension this means that they should be

more appropriately classified as Stage 2 or Stage 3. However, our analysis shows that this is not occurring. When compared to Stage 1 patients, the likelihood of Stage 2 or Stage 3 patients being classified correctly is significantly lower (odds ratio = 0.40 and 0.12 respectively). Providers clearly struggle when it comes to correctly classifying Stage 2 and Stage 3 patients and our findings suggest that it may be related to the misconception regarding the applicability of the TBC guidelines to chronic patients.

In our study we also found interaction effects between physical therapists' personal and professional characteristics and organizational factors. Our quantitative analysis showed that having any type of professional certification was generally associated with higher TBC adherence. However, in this subgroup there were other personal and organizational factors that could negatively or positively influence adherence. For example, adherence suffers as Uncertainty Paralysis or LBP patient volume increased. Conversely, adherence improves as connections with colleagues and time to deliver quality care increase. Multiple interaction effects can be difficult to interpret; however, our qualitative study provides some insight into these findings.

We also interviewed a few individuals who identified themselves as having a unique patient population as a result of their specialization. Two of them specialized in women's health and one was an orthopedic specialist focused on knee and shoulder conditions. All three indicated that they treat patients with a primary complaint of LBP; however; they also reported that their patients commonly had other comorbid and/or complicating factors that provided additional challenges. It seems plausible that providers with complex, special patient populations may have more difficulty with adherence to the TBC if they are intolerant of uncertainty. It is also reasonable for their performance to suffer as their patient load increases or

time for quality care decreases. Likewise, performance would be expected to improve when they have strong connections with colleagues with whom they can consult on clinical matters. However, not all providers with professional certifications necessarily have highly specialized patient populations.

According to the American Physical Therapy Association there are now more than 20,000 providers with professional certifications with 2,000 new certifications each year.[172] Within CRS almost 40% of the providers have some type of professional certification; therefore, this is an important subgroup. Our results indicate that two organizational factors, *time to deliver quality care* and *connection with colleagues*, are facilitators to TBC adherence in this group of providers. Obviously, the balance between time and productivity is a delicate one, especially given the current market dynamics. However, our results show that as the time available to deliver care goes up, there is a proportional increase in TBC adherence. Similarly, when providers feel they have open, constructive and valued exchanges about patient care with their peers and those in authority, TBC guideline adherence is also improved. The importance of these inter-personal connections was hinted at in some of the interviews. For example, one provider said "…I have a couple of coworkers that I can go to if I know I need help."

Another organizational factor that may influence TBC adherence is *leadership*. Senior leaders can encourage innovation, create capacity, and provide the resources necessary for change.[167,168] There is also evidence that first-level leaders can be important facilitators of evidence-based practice implementation.[37,39,173] We briefly explored this construct in our interviews with therapists. In these interviews we found there was almost universal agreement that the senior leadership at CRS placed a high importance on the TBC guidelines and expected patients to be managed accordingly. Conversely, over 60% of interviewees indicated that their

immediate supervisor was indifferent or had a negative view towards the TBC guidelines. In light of this finding, we went back and examined the association between TBC adherence and the leadership subscale scores. In both the multilevel, mixed effects model and the generalized linear model there was a negative, albeit non-significant, association with TBC adherence. Perhaps the indifferent or negative views of front line supervisors are adversely impacting those therapists who they supervise.

As predicted by the CFIR, there are several factors influencing physical therapist adherence to the TBC guidelines. The factors are concentrated in three of the five domains. Consistent with our hypotheses, the quantitative analysis found that specific characteristics of the individuals and the organization that are associated with TBC adherence. We also found that there were cross-domain interactions between these factors, which was also consistent with our hypotheses. Finally, we also hypothesized that characteristics of the innovation would not be associated with TBC adherence. This was supported in the quantitative analysis; however, our qualitative analysis revealed what appear to be important aspects of the TBC that are posing additional barriers to adherence.

4.1 LESSONS LEARNED

The complementarity of findings from the qualitative and quantitative components of the study was most illuminating. In some instances one method identified important factors that the other did not. However, in most instances the findings from one component were substantiated or more fully explained by findings from the other methods. For example, the interviews were essential in uncovering the barriers of classification uncertainty and patient staging that were

associated with adherence to the TBC. Just as important, the quantitative analysis provided data regarding the influences of Uncertainty Paralysis and patient staging as barriers to TBS adherence, which strengthened the conclusions that were drawn from the qualitative analysis. Similarly, the quantitative analysis uncovered complex interactions and potential organizational supports that were only hinted at in a few of the provider interviews. Without the combination of both methods, the robustness of the study would have suffered from relying solely on either method exclusively.

There were two key issues encountered during the quantitative study. First, the TBC adherence index did not identify any statistically significant performance differences between providers. One reason for this finding was the inclusion of low volume providers. The confidence intervals around the point estimates for low volume providers are wider, which decreases the probability of finding significant differences. It wasn't until all providers with fewer than 30 LBP patients were excluded from our analysis that significant performance differences identified. Even at this level of patient volume there was only one provider whose performance was statistically different; meanwhile, the provider sample size was reduced by 64%. The gain of one significantly different provider was not deemed worthy of the required drastic reduction in sample size.

The homogeneity of provider performance explains the other issue encountered during the quantitative analysis. It was originally planned to use logistic regression to explore the differences between high and low performing providers. However, because provider performance was so homogeneous there were no differences in implementation factors when the provider population was dichotomized in this fashion. It actually turned out that the generalized

linear models fit the data much better. Clearly, the lesson to be learned here is that it is important to be willing to adjust one's approach as circumstances dictate.

While it would have been ideal to find statistically significant performance differences, that was not the sole purpose for calculating the TBC adherence index. An important reason to use the risk-adjusted performance index was to control for patient variability in an effort to more effectively assess between provider variability. If this analysis were redone today using a different time period, the relative ranking of providers would change. Some of the change would reflect real change in performance and some would reflect randomness. However, given the strong convergence between the quantitative and qualitative findings, it is unlikely that the primary conclusions would change. Namely, *classification uncertainty* and *patient staging* are key issues that providers struggle with to varying degrees and these factors can be influenced both positively and negatively by characteristics of the individual and organization.

4.2 FUTURE DIRECTIONS

A logical extension of this study would be the development and testing of an implementation strategy to improve adherence with the TBC within the CRS system. This study has identified several barriers and facilitators to adherence with TBC. However, due to the complex nature of health care environments, it is advisable to use a structured framework for planning any such future implementation strategy.[19] We would suggest the use of the Intervention Mapping framework for this purpose.

Intervention Mapping is a planning framework that utilizes theory, evidenced-based interventions and practical strategies to design programs targeting multi-level changes.[73] This framework could allow the findings from the current study to be used to specify performance objectives that could be used to customize the development of an intervention strategy designed to target provider and organizational behavior change and to work with our clinical partner (CRS) to identify the most feasible solution.[68,73,174]

Additionally, work should continue toward an effort to improve the TBC performance index. In this era of provider accountability, measurement of clinical performance is becoming increasingly common. However, much of the current work in this area has focused on hospital and physician profiling. Creating valid and reliable measurement tools to assess the performance of rehabilitation providers is urgently needed. To date, a preferred method for creating risk adjusted profiles has not been determined.[132] Therefore, future work should build upon the multilevel, mixed effects model used in this study to improve discrimination and calibration.[133] The same approach should be taken using fixed effects models and the results compared.[132]

APPENDIX A

UPMC CENTERS FOR REHAB SERVICES LOW BACK PAIN MINIMUM DATA SET

LOW BACK PAIN FORM

DEMOGRAPHICS (Initial Only)

Status: ☐ Licensed PT ☐ Student PT Date (Initial): _____

Patient ID: _____ Gender: ☐ Male ☐ Female

HISTORY (Initial Only)

Location (check one)
- ☐ LBP
- ☐ LBP and buttock/thigh symptoms (not distal to knee)
- ☐ LBP and leg symptoms distal to knee

Duration
- ☐ ≤ 15 Days
- ☐ > 15 Days

Location of other symptoms (check all that apply)
- ☐ N/A
- ☐ Head/Neck
- ☐ Thoracic Spine
- ☐ Upper Extremity (ies)
- ☐ Hip(s)
- ☐ Knee(s)
- ☐ Foot/Feet

FABQ
PA _____
WK _____

Post Surgical
- ☐ Yes
- ☐ No

Sought medical care for this same episode in the past?
☐ Yes ☐ No

Previous episodes of LBP ☐ 0 ☐ 1-2 ☐ 3-5 ☐ >5

Frequency Increasing ☐ Yes ☐ No

PHYSICAL EXAM: ☐ **Initial** ☐ **Follow-up** **Date:**_____

Avg SLR
- ☐ ≥ 91
- ☐ < 91

Prone Instability Test
- ☐ Positive
- ☐ Negative

Mobility Testing
- ☐ Hypo
- ☐ Normal
- ☐ Hyper

Directional Preference
- ☐ Extension
- ☐ Flexion
- ☐ No Directional Preference

Aberrant Movements
- ☐ Yes
- ☐ No

Pain (worst): _____ Flexion ROM: _____ Oswestry: _____

TREATMENT CLASSIFICATION (Initial & Weekly)

Stage I (check one)
- ☐ Thrust Mobilization (Grade V)
- ☐ Non Thrust Mobilization (Grade I-IV)
- ☐ Stabilization
- ☐ Flexion Directional Preference
- ☐ Extension Directional Preference
- ☐ Traction

Stage II (check all that apply)
- ☐ Aerobic
- ☐ General Conditioning

FABQW Status (check one)
- ☐ Negative (<29)
- ☐ "At Risk" (29-34)
- ☐ Positive (>34)

FABQPA Status
- ☐ Positive (>14)
- ☐ Negative (≤14)

NOTE: You must check
1. One Stage I category ***or*** one or more stage II categories ***and***
2. One FABQ status (initial only; weekly optional)

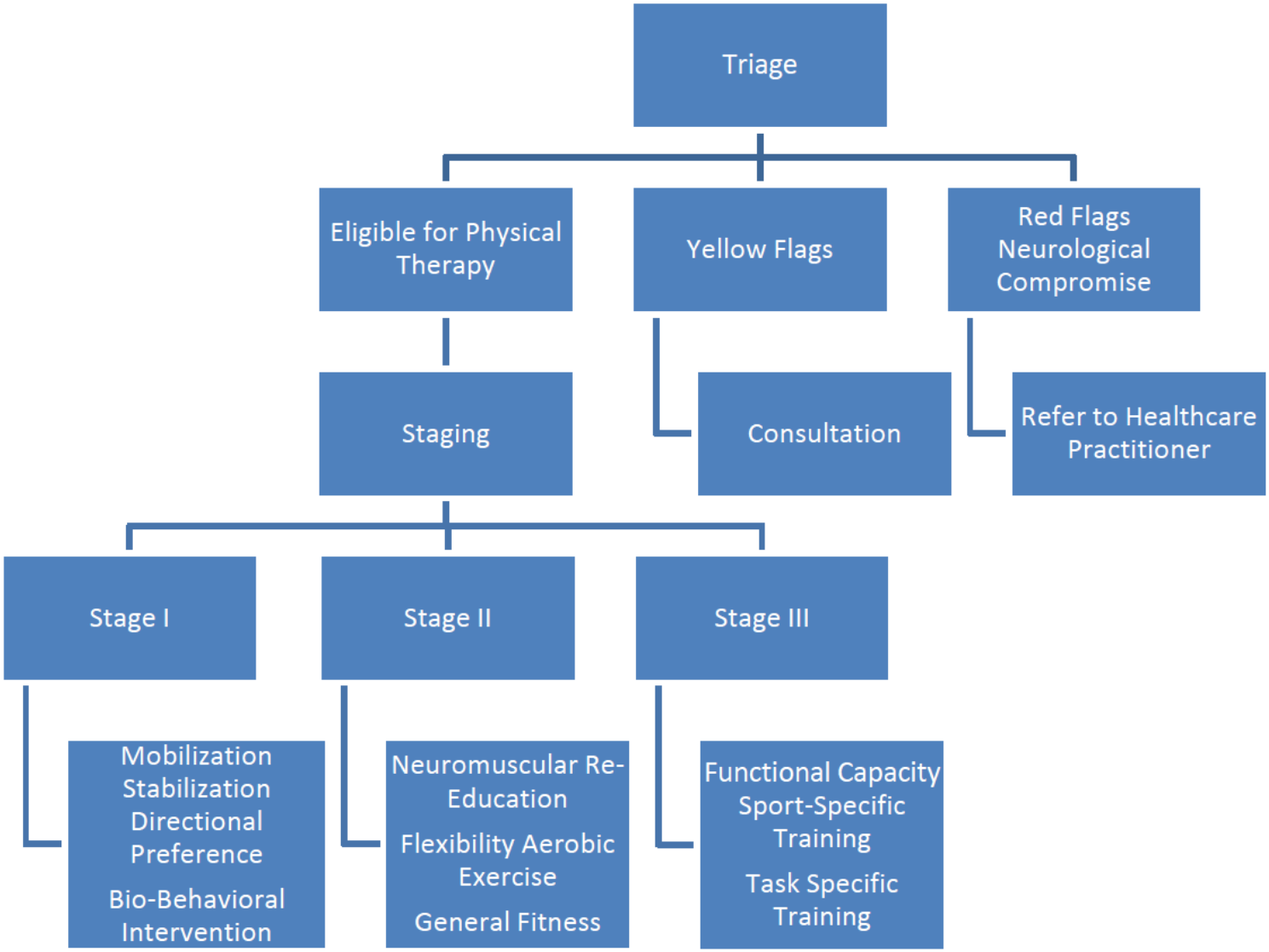
INTERVENTIONS (Initial & Weekly) (check all that apply)
- ☐ Patient Education/Instruction
- ☐ Flexion Exercises
- ☐ Extension Exercises
- ☐ Flexibility Exercises
- ☐ Stabilization Exercises
- ☐ General Conditioning Exercises
- ☐ Thrust Mobilization (Grade V)
- ☐ Non Thrust Mobilization (Grade I-IV)
- ☐ Aerobic Exercise
- ☐ Functional Training
- ☐ Heat Modalities
- ☐ Cold Modalities
- ☐ Traction – Mechanical
- ☐ Traction – Autotraction
- ☐ De-weighting / Unloading
- ☐ Behavioral Exercise Approach
- ☐ NMES (Strengthening)
- ☐ NMES (Pain Control)
- ☐ Soft Tissue Massage
- ☐ Myofacial Release
- ☐ Craniosacral Therapy
- ☐ Other

APPENDIX B

UPMC CENTERS FOR REHAB SERVICES TREATMENT BASED CLASSIFICATION

CLINICAL DECISION MAKING GUIDELINES

TREATMENT BASED CLASSIFICATION CLINICAL DECISION MAKING GUIDELINES



APPENDIX C

PHYSICAL THERAPIST SURVEY: DEMOGRAPHICS AND PROFESSIONAL CHARACTERISTICS

Low Back Pain Quality Initiative – Physical Therapist Survey

Demographics and Professional Characteristics

Thank you in advance for taking the time to complete this survey.

The goal of this project is to use your feedback to identify ways to improve the Low Back Initiative (LBI).

Previous research has shown that clinical quality improvement projects, like the LBI, can be affected by numerous factors. This research has found that barriers can result from factors related to the:

- Organization (e.g., culture, leadership, informal interactions);
- Scientific evidence (e.g., strength, acceptability, alignment with current practice);
- Individuals (e.g., beliefs, attitudes, traits); and
- Implementation processes (e.g., resources, champions, resources).

This survey will explore these areas to identify the dynamics at play with the ultimate goal of providing actionable improvement recommendations.

To achieve this goal we need your candid input. **The survey will take approximately 50-60 minutes to complete and it is OK to respond during working hours.** Also, it is important to note that you do not need to complete the survey all at once.

Your responses will be kept strictly confidential and no personally identifiable information will be shared with any member of the CRS management team and staff.

1. What is your gender?

- ◯ Female
- ◯ Male

2. Please indicate your age group by checking one of the following:

- ◯ Less than 20 years
- ◯ 20-24 years
- ◯ 25-29 years
- ◯ 30-34 years
- ◯ 35-39 years
- ◯ 40-44 years
- ◯ 45-49 years
- ◯ 50-54 years
- ◯ 55-59 years
- ◯ 60-64 years
- ◯ 65-70 years
- ◯ More than 70 years

Low Back Pain Quality Initiative – Physical Therapist Survey

3. What is your ethnicity?

- ◯ Hispanic or Latino
- ◯ Not Hispanic or Latino

4. What is your race? Please choose one or more.

- ☐ White
- ☐ Black or African-American
- ☐ Asian
- ☐ Native Hawaiian or other Pacific Islander
- ☐ American Indian or Alaska Native

5. What is the highest earned degree (or degrees) you hold in any area of study?

- ◯ Baccalaureate degree (BS)
- ◯ Master's degree (MS/MPT)
- ◯ DPT
- ◯ tDPT
- ◯ PhD (or equivalent, e.g. EdD or ScD)
- ◯ PhD (or equivalent) and DPT
- ◯ PhD (or equivalent) and tDPT
- ◯ Other (please specify)

6. At what university did you earn your highest degree?

7. What was your first (entry-level) physical therapy degree, prior to taking the licensure exam?

- ◯ Baccalaureate degree
- ◯ Post baccalaureate certificate
- ◯ Master's degree
- ◯ DPT
- ◯ Other (please specify)

Low Back Pain Quality Initiative – Physical Therapist Survey

8. At what university did you earn your first (entry-level) physical therapy degree?

9. What year did you receive your physical therapy license?

10. Please indicate which of the following specialty certifications you hold (check all that apply):

- ☐ Cardiovascular & Pulmonary Certified Specialist (CCS)
- ☐ Clinical Electrophysiology Certified Specialist (ECS)
- ☐ Geriatric Certified Specialist (GCS)
- ☐ Neurologic Certified Specialist (NCS)
- ☐ Orthopedic Certified Specialist (OCS)
- ☐ Sports Certified Specialist (SCS)
- ☐ Pediatric Certified Specialist (PCS)
- ☐ None
- ☐ Other (e.g. McKenzie, manual therapy, etc.)

11. How long have you worked at CRS?

Years

Months

12. What clinic do you work at most of the time?

13. How long have you worked at this clinic?

Years

Months

Low Back Pain Quality Initiative – Physical Therapist Survey

Personal Low Back Pain History

1. Do you have or have you ever had low back pain that lasted <u>more than a few hours</u>?

- ◯ Yes
- ◯ No

APPENDIX D

PHYSICAL THERAPIST SURVEY: PAIN ATTITUDES AND BELIEFS SCALE FOR PHYSICAL THERAPISTS

Low Back Pain Quality Initiative – Physical Therapist Survey

Beliefs, Attitudes, and Traits

We would like you to indicate the level to which you agree or disagree with each statement as it relates to the treatment of back pain. Please tick off the appropriate response for each of the following questions.

1. The severity of tissue damage determines the level of pain.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

2. Increased pain indicates new tissue damage or the spread of existing damage.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

3. Pain is a nociceptive stimulus, indicating tissue damage.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

4. If back pain increases in severity, I immediately adjust the intensity of my treatment accordingly.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

5. If patients complain of pain during exercise, I worry that damage is being caused.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

6. Patients with back pain should preferably practice only pain free movements.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

7. Pain reduction is a precondition for the restoration of normal functioning.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

8. If therapy does not result in a reduction in back pain, there is a high risk of severe restrictions in the long term.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

9. Back pain indicates the presence of organic injury.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

10. In the long run, patients with back pain have a higher risk of developing spinal impairments.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

11. Learning to cope with stress promotes recovery from back pain.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

12. A patient suffering from severe back pain will benefit from physical exercise.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

13. Even if the pain has worsened, the intensity of the next treatment can be increased.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

14. Exercises that may be back straining should not be avoided during the treatment.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

15. Therapy may have been successful even if pain remains.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

16. The cause of back pain is unknown.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

17. Functional limitations associated with back pain are the result of psychosocial factors.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

18. There is no effective treatment to eliminate back pain.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

19. Mental stress can cause back pain even in the absence of tissue damage.

Totally Disagree	Largely Disagree	Disagree to Some Extent	Agree to Some Extent	Largely Agree	Totally Agree
○	○	○	○	○	○

APPENDIX E

PHYSICAL THERAPIST SURVEY: INTOLERANCE FOR UNCERTAINTY SCALE

Low Back Pain Quality Initiative – Physical Therapist Survey

Beliefs, Attitudes, and Traits

You will find below a series of statements which describe how people may react to the uncertainties of life. Please use the scale below to describe to what extent each item is characteristic of you. Please tick one of the five response that describes you best.

1. Unforeseen events upset me greatly.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

2. It frustrates me not having all the information I need.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

3. Uncertainty keeps me from living a full life.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

4. One should always look ahead so as to avoid surprises.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

5. A small unforeseen event can spoil everything, even with the best of planning.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

6. When it's time to act, uncertainty paralyzes me.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

7. When I am uncertain I can't function very well.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

8. I always want to know what the future has in store for me.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

9. I can't stand being taken by surprise.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

10. The smallest doubt can stop me from acting.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

11. I should be able to organize everything in advance.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

12. I must get away from all uncertain situations.

Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely charactersitic of me
○	○	○	○	○

APPENDIX F

PHYSICAL THERAPIST SURVEY: RESISTANCE TO CHANGE SCALE

Low Back Pain Quality Initiative – Physical Therapist Survey

Beliefs, Attitudes, and Traits

Listed below are several statements regarding one's general belief and attitudes towards change. Please indicate the degree to which you agree or disagree with each statement by ticking the appropriate response.

1. I generally consider changes to be a negative thing.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

2. I'll take a routine day over a day full of unexpected events anytime.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

3. I like to do the same old things rather than try new and different ones.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

4. Whenever my life forms a stable routine, I look for ways to change it.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

5. I'd rather be bored than surprised.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

6. If I were to be informed that there's going to be a significant change regarding the way things are done at work, I would probably feel stressed.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

7. When I am informed of a change of plans, I tense up a bit.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

8. When things don't go according to plans, it stresses me out.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

9. If my boss changed the performance evaluation criteria, it would probably make me feel uncomfortable even if I thought I'd do just as well without having to do extra work.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

10. Changing plans seems like a real hassle to me.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

11. Often, I feel a bit uncomfortable even about changes that may potentially improve my life.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

12. When someone pressures me to change something, I tend to resist it even if I think the change may ultimately benefit me.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

13. I sometimes find myself avoiding changes that I know will be good for me.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

14. I often change my mind.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

15. I don't change my mind easily.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

16. Once I've come to a conclusion, I'm not likely to change my mind.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

17. My views are very consistent over time.

Strongly Disagree	Disagree	Inclined to Disagree	Inclined to Agree	Agree	Strongly Agree
○	○	○	○	○	○

APPENDIX G

PHYSICAL THERAPIST SURVEY: CORE SELF-EVALUATIONS SCALE

Low Back Pain Quality Initiative – Physical Therapist Survey

Beliefs, Attitudes, and Traits

Below are several statements about you with which you may agree or disagree. Using the response scale below, indicate your agreement or disagreement with each item by ticking the appropriate choice.

1. I am confident I get the success I deserve in life.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

2. Sometimes I feel depressed.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

3. When I try, I generally succeed.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

4. Sometimes when I fail I feel worthless.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

5. I complete tasks successfully.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

6. Sometimes, I do not feel in control of my work.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

7. Overall, I am satisfied with myself.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

8. I am filled with doubts about my competence.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

9. I determine what will happen in my life.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

10. I do not feel in control of my success in my career.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

11. I am capable of coping with most of my problems.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

12. There are times when things look pretty bleak and hopeless to me.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

APPENDIX H

PHYSICAL THERAPIST SURVEY: ALBERTA CONTEXT TOOL

Low Back Pain Quality Initiative – Physical Therapist Survey

Leadership

In answering the following, please focus on the leadership behavior of the person you primarily report to. If this leadership involves a variety of individuals at various times, select the one person who is most representative of the group.

Please indicate your level of agreement with the following statements by ticking the appropriate box for each question.

The leader…

1. looks for feedback even when it is difficult to hear.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

2. focuses on successes rather than failures.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

3. calmly handles stressful situations.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

4. actively listens, acknowledges, and then responds to requests and concerns.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

5. actively mentors or coaches performance of others.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

6. effectively resolves conflicts that arise.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Culture

Culture is the way that "we do things" in our organizations and clinics. When answering the following questions please focus on the clinic that you work in most of the time.

Please indicate your level of agreement with the following statements by ticking the appropriate box for each question.

1. I receive recognition from others about my work.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

2. I have control over *how* I do my work.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

3. My organization effectively *balances* best practice and productivity.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

4. I am supported to undertake professional development.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

5. We work to provide what patients and families need.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

6. I am a member of a supportive work group.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

Low Back Pain Quality Initiative – Physical Therapist Survey

Feedback

One step that has been identified in achieving best-practice is to analyze and use data to assess group or team performance and to achieve desired outcomes. Some examples of such data include: *pain control, functional improvement, and patient or family satisfaction.*

Please indicate your level of agreement with the following statements with respect to the clinic that you work in most of the time by ticking the appropriate box for each question.

1. I routinely receive information on my clinic's performance on data *like* the examples provided above.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

2. Our clinic routinely discusses this data informally.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

3. Our clinic has a scheduled formal process for discussing this data.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

4. Our clinic routinely formulates action plans based on the data.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

5. Our clinic routinely monitors our performance with respect to the action plans.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

6. Our clinic routinely compares our performance with others.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Formal Interactions

Think about the clinic that you work in most of the time.

In the last typical MONTH, how often did you participate in the following? Please tick the appropriate box of reach question.

1. Clinic meetings?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

2. Patient rounds (related to review of overall patient care)?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

3. Family conferences?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Formal Interactions

Think about the clinic that you work in most of the time.

In the past YEAR, how often have you attended the following? Please tick the appropriate box.

1. Continuing education (e.g. conferences, courses, workshops) held *outside* your organization?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Informal Interactions

Think about the clinic that you work in most of the time.

In the last typical MONTH, how often did you have a patient care related discussion with individuals or groups of people in the following roles or situations? Please tick the appropriate box for each question.

1. Other professionals in my discipline?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

2. Physicians?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

3. Nurse providers (e.g., nurse practitioner)?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

4. Other health care providers (other than physicians or nurses)?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

5. Research coordinator?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

6. Any clinical educator/instructor/clinical specialist?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

7. Quality improvement representative/specialist?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

8. Someone who *champions* research in practice?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

9. 'Hallway talk' (e.g., informal discussions in the hallway, the clinical areas)?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

10. Informal teaching sessions?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Connections Among People

Please answer the following questions as they relate to the clinic that you work in most of the time.

Consider the group/team of health care providers that work in that clinic and indicate your level of agreement with the following statements by ticking the appropriate box for each question.

1. People in the group share information with others in the group.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

2. My observations about patient conditions are routinely taken seriously by those in positions of authority.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

3. People in other groups share information with people in my group.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

4. I am comfortable talking about patient care issues with those in positions of authority.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

5. The aim of group exchanges is to help others do their job.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

6. Individuals who participate in group activities are valued by others in the group.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Structural and Electronic Resources

Please answer the following questions as they relate to the clinic that you work in most of the time.

In the last typical MONTH, how often did you use the following while at work? Please tick the appropriate box for each question.

1. A library?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

2. Text books?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

3. Journals (print/on-line)?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

4. Notice boards in your area?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

5. Policies and procedures (print/on-line)?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

6. Clinical practice guidelines?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

7. In-services/workshops/courses in your organization?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

8. Computerized decision support (computer programs to assist with care and decision making)?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

9. Reminder systems (e.g. notices via e-mail)?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

10. Website(s) on the internet?

Never	Rarely	Occasionally	Frequently	Almost Always	Not Available
○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Staffing

Please indicate your level of agreement with the following statements with respect to the clinic that you work in most of the time by ticking the appropriate box for each question.

1. We have enough staff to get the *necessary* work done.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

2. We have enough staff to deliver quality care.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
◯	◯	◯	◯	◯

Low Back Pain Quality Initiative – Physical Therapist Survey

Space

Please answer the following questions as they relate to the clinic that you work in most of the time by ticking the appropriate box for each question.

1. We have adequate *space* to provide patient care.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

2. We have a *private space* such as a conference room (*other than* the clinical or office areas) to discuss confidential information about patients, patient care plans and share knowledge about patient care.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Space

Please answer the following question as it relates to the clinic that you work in most of the time by ticking the appropriate box for the question.

1. How often do you use this *private space* to discuss confidential patient information, care plans or new clinical knowledge?

Never	Rarely	Occasionally	Frequently	Almost Always
○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Time

Please answer the following questions as they relate to the clinic that you work in most of the time by ticking the appropriate box for each question.

How often do you…

1. have time to do something extra for patients?

Never	Rarely	Occasionally	Frequently	Almost Always
◯	◯	◯	◯	◯

2. have time to talk to someone about the *plan of care* for patients?

Never	Rarely	Occasionally	Frequently	Almost Always
◯	◯	◯	◯	◯

3. have time to look something up (e.g., in a journal, a book, or on the internet)?

Never	Rarely	Occasionally	Frequently	Almost Always
◯	◯	◯	◯	◯

4. have time to talk to someone about *new clinical knowledge*?

Never	Rarely	Occasionally	Frequently	Almost Always
◯	◯	◯	◯	◯

APPENDIX I

PHYSICAL THERAPIST SURVEY: OTTAWA ACCEPTABILITY OF DECISION RULES INSTRUMENT

Low Back Pain Quality Initiative – Physical Therapist Survey

Biobehavioral Classification Rule

The Low Back Initiative (LBI) uses a classification system to help guide treatment given the therapist's evaluative findings and current evidence based practice. According to the LBI decision making algorithm three steps should be taken when identifying the appropriate classification:

Step 1. Determine if the patient is appropriate for PT management – identifying Red and Yellow Flags
Step 2. Determine the patient's acuity level – Staging the patient to define goals and treatment
Step 3. Determine the best treatment approach for acute patients – guidance by Clinical Prediction Rules

During Step #1 the presence of Yellow Flags (i.e., psychological or behavioral factors) should be assessed after Red Flags have been ruled out. According to the Biobehavioral Classification rule, patients should be placed in this classification when their Fear Avoidance Beliefs Questionnaire (FABQ) Activity subscale score is greater than 14 or their Work subscale score is equal to or greater than 29.

Please indicate your level of agreement with each of the following statements about the Biobehavioral Classification rule by clicking on the appropriate box. If you do not currently use this rule in practice, please answer the questions as if you were considering using the rule (the rule would be easy to use, etc.).

1. The rule is easy to use.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

2. The rule is easy to remember.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

3. The rule is useful in my practice.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

4. The wording of the rule is clear and unambiguous.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

5. My colleagues support use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

6. Patients benefit from use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

7. Using the rule results in improved use of resources.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

8. Using the rule would increase the chance of lawsuits.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

9. The evidence supporting the rule is flawed.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

10. I am already using another rule or similar strategy.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

11. The rule does not account for an important clinical cue.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

12. The environment I work in makes it difficult to use the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Stage 1 Classification Rule

The Low Back Initiative (LBI) uses a classification system to help guide treatment given the therapist's evaluative findings and current evidence based practice. According to the LBI decision making algorithm three steps should be taken when identifying the appropriate classification:

Step 1. Determine if the patient is appropriate for PT management – identifying Red and Yellow Flags
Step 2. Determine the patient's acuity level – Staging the patient to define goals and treatment
Step 3. Determine the best treatment approach for acute patients – guidance by Clinical Prediction Rules

During Step #2 the patient should be classified into one of three Stages based on their acuity level. According to the Stage 1 Classification rule, patients should be placed in this classification when their Modified Low Back Pain Disability Index (i.e., Oswestry) score exceeds 30 percent.

Please indicate your level of agreement with each of the following statements about the Stage 1 Classification rule by clicking on the appropriate box. If you do not currently use this rule in practice, please answer the questions as if you were considering using the rule (the rule would be easy to use, etc.).

1. The rule is easy to use.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

2. The rule is easy to remember.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

3. The rule is useful in my practice.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

4. The wording of the rule is clear and unambiguous.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

5. My colleagues support use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

6. Patients benefit from use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

7. Using the rule results in improved use of resources.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

8. Using the rule would increase the chance of lawsuits.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

9. The evidence supporting the rule is flawed.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

10. I am already using another rule or similar strategy.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

11. The rule does not account for an important clinical cue.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

12. The environment I work in makes it difficult to use the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Stage 2 Classification Rule

The Low Back Initiative (LBI) uses a classification system to help guide treatment given the therapist's evaluative findings and current evidence based practice. According to the LBI decision making algorithm three steps should be taken when identifying the appropriate classification:

Step 1. Determine if the patient is appropriate for PT management – identifying Red and Yellow Flags
Step 2. Determine the patient's acuity level – Staging the patient to define goals and treatment
Step 3. Determine the best treatment approach for acute patients – guidance by Clinical Prediction Rules

During Step #2 the patient should be classified into one of three Stages based on their acuity level. According to the Stage 2 Classification rule, patients should be placed in this classification when their Modified Low Back Pain Disability Index (i.e., Oswestry) score is 15 to 30 percent.

Please indicate your level of agreement with each of the following statements about the Stage 2 Classification rule by clicking on the appropriate box. If you do not currently use this rule in practice, please answer the questions as if you were considering using the rule (the rule would be easy to use, etc.).

1. The rule is easy to use.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

2. The rule is easy to remember.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

3. The rule is useful in my practice.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

4. The wording of the rule is clear and unambiguous.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

5. My colleagues support use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

6. Patients benefit from use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

7. Using the rule results in improved use of resources.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

8. Using the rule would increase the chance of lawsuits.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

9. The evidence supporting the rule is flawed.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

10. I am already using another rule or similar strategy.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

11. The rule does not account for an important clinical cue.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

12. The environment I work in makes it difficult to use the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Stage 3 Classification Rule

The Low Back Initiative (LBI) uses a classification system to help guide treatment given the therapist's evaluative findings and current evidence based practice. According to the LBI decision making algorithm three steps should be taken when identifying the appropriate classification:

Step 1. Determine if the patient is appropriate for PT management – identifying Red and Yellow Flags
Step 2. Determine the patient's acuity level – Staging the patient to define goals and treatment
Step 3. Determine the best treatment approach for acute patients – guidance by Clinical Prediction Rules

During Step #2 the patient should be classified into one of three Stages based on their acuity level. According to the Stage 3 Classification rule, patients should be placed in this classification when their Modified Low Back Pain Disability Index (i.e., Oswestry) score is less than 15 percent.

Please indicate your level of agreement with each of the following statements about the Stage 3 Classification rule by clicking on the appropriate box. If you do not currently use this rule in practice, please answer the questions as if you were considering using the rule (the rule would be easy to use, etc.).

1. The rule is easy to use.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

2. The rule is easy to remember.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

3. The rule is useful in my practice.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

4. The wording of the rule is clear and unambiguous.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

5. My colleagues support use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

6. Patients benefit from use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

7. Using the rule results in improved use of resources.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

8. Using the rule would increase the chance of lawsuits.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

9. The evidence supporting the rule is flawed.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

10. I am already using another rule or similar strategy.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

11. The rule does not account for an important clinical cue.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

12. The environment I work in makes it difficult to use the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Specific Exercise Classification Rule

The Low Back Initiative (LBI) uses a classification system to help guide treatment given the therapist's evaluative findings and current evidence based practice. According to the LBI decision making algorithm three steps should be taken when identifying the appropriate classification:

Step 1. Determine if the patient is appropriate for PT management – identifying Red and Yellow Flags
Step 2. Determine the patient's acuity level – Staging the patient to define goals and treatment
Step 3. Determine the best treatment approach for acute patients – guidance by Clinical Prediction Rules

During Step #3 the Clinical Prediction Rules should be used to determine the best treatment approach for acute (i.e., Stage 1) patients. According to the Specific Exercise Classification rule, patients should be placed in this classification when they have pain past the knee AND the pain centralizes with two or more movements in the same direction OR the pain centralizes with a movement in one direction and peripheralizes with a movement in the opposite direction.

Please indicate your level of agreement with each of the following statements about the Specific Exercise Classification rule by clicking on the appropriate box. If you do not currently use this rule in practice, please answer the questions as if you were considering using the rule (the rule would be easy to use, etc.).

1. The rule is easy to use.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

2. The rule is easy to remember.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

3. The rule is useful in my practice.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

4. The wording of the rule is clear and unambiguous.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

5. My colleagues support use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

6. Patients benefit from use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

7. Using the rule results in improved use of resources.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

8. Using the rule would increase the chance of lawsuits.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

9. The evidence supporting the rule is flawed.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

10. I am already using another rule or similar strategy.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

11. The rule does not account for an important clinical cue.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

12. The environment I work in makes it difficult to use the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Manipulation Classification Rule

The Low Back Initiative (LBI) uses a classification system to help guide treatment given the therapist's evaluative findings and current evidence based practice. According to the LBI decision making algorithm three steps should be taken when identifying the appropriate classification:

Step 1. Determine if the patient is appropriate for PT management – identifying Red and Yellow Flags
Step 2. Determine the patient's acuity level – Staging the patient to define goals and treatment
Step 3. Determine the best treatment approach for acute patients – guidance by Clinical Prediction Rules

During Step #3 the Clinical Prediction Rules should be used to determine the best treatment approach for acute (i.e., Stage 1) patients. According to the Manipulation Classification rule, patients should be placed in this classification when they have a recent onset of symptoms (< 16 days) AND there are no symptoms past the knee.

Please indicate your level of agreement with each of the following statements about the Manipulation Classification rule by clicking on the appropriate box. If you do not currently use this rule in practice, please answer the questions as if you were considering using the rule (the rule would be easy to use, etc.).

1. The rule is easy to use.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

2. The rule is easy to remember.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

3. The rule is useful in my practice.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

4. The wording of the rule is clear and unambiguous.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

5. My colleagues support use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

6. Patients benefit from use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

7. Using the rule results in improved use of resources.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

8. Using the rule would increase the chance of lawsuits.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

9. The evidence supporting the rule is flawed.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

10. I am already using another rule or similar strategy.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

11. The rule does not account for an important clinical cue.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

12. The environment I work in makes it difficult to use the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Stabilization Classification Rule

The Low Back Initiative (LBI) uses a classification system to help guide treatment given the therapist's evaluative findings and current evidence based practice. According to the LBI decision making algorithm three steps should be taken when identifying the appropriate classification:

Step 1. Determine if the patient is appropriate for PT management – identifying Red and Yellow Flags
Step 2. Determine the patient's acuity level – Staging the patient to define goals and treatment
Step 3. Determine the best treatment approach for acute patients – guidance by Clinical Prediction Rules

During Step #3 the Clinical Prediction Rules should be used to determine the best treatment approach for acute (i.e., Stage 1) patients. According to the Stabilization Classification rule, patients should be placed in this classification when they have at least three of the following:

1) Average straight leg raise range of motion greater than 91 degrees;
2) Positive prone instability test;
3) Positive aberrant movements; OR
4) Age less than 40 years.

Please indicate your level of agreement with each of the following statements about the Stabilization Classification rule by clicking on the appropriate box. If you do not currently use this rule in practice, please answer the questions as if you were considering using the rule (the rule would be easy to use, etc.).

1. The rule is easy to use.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

2. The rule is easy to remember.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

3. The rule is useful in my practice.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

4. The wording of the rule is clear and unambiguous.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

5. My colleagues support use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

6. Patients benefit from use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

7. Using the rule results in improved use of resources.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

8. Using the rule would increase the chance of lawsuits.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

9. The evidence supporting the rule is flawed.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

10. I am already using another rule or similar strategy.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

11. The rule does not account for an important clinical cue.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

12. The environment I work in makes it difficult to use the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

Traction Classification Rule

The Low Back Initiative (LBI) uses a classification system to help guide treatment given the therapist's evaluative findings and current evidence based practice. According to the LBI decision making algorithm three steps should be taken when identifying the appropriate classification:

Step 1. Determine if the patient is appropriate for PT management – identifying Red and Yellow Flags
Step 2. Determine the patient's acuity level – Staging the patient to define goals and treatment
Step 3. Determine the best treatment approach for acute patients – guidance by Clinical Prediction Rules

During Step #3 the Clinical Prediction Rules should be used to determine the best treatment approach for acute (i.e., Stage 1) patients. According to the Traction Classification rule, patients should be placed in this classification when they have pain past the knee AND no directional preference during static or dynamic testing.

Please indicate your level of agreement with each of the following statements about the Traction Classification rule by clicking on the appropriate box. If you do not currently use this rule in practice, please answer the questions as if you were considering using the rule (the rule would be easy to use, etc.).

1. The rule is easy to use.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

2. The rule is easy to remember.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

3. The rule is useful in my practice.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

4. The wording of the rule is clear and unambiguous.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

5. My colleagues support use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

6. Patients benefit from use of the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

Low Back Pain Quality Initiative – Physical Therapist Survey

7. Using the rule results in improved use of resources.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

8. Using the rule would increase the chance of lawsuits.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

9. The evidence supporting the rule is flawed.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

10. I am already using another rule or similar strategy.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

11. The rule does not account for an important clinical cue.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

12. The environment I work in makes it difficult to use the rule.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	No Opinion / Don't Know
○	○	○	○	○	○	○

APPENDIX J

TREATMENT BASED CLASSIFICATION ADMINISTRATIVE DATASET CODING ALGORITHM

Treatment Based Classification Administrative Dataset Coding Algorithm

Step 1 – Code BB_WK field

- If FABQ_WK > 34 = Positive
- If FABQ_WK is 29 to 34 = At Risk
- If FABQ_WK < 29 = Negative
- If FABQ_WK is Null and FABQW_STATUS is GT 34 = Positive
- If FABQ_WK is Null and FABQW_STATUS is 29-34 = At Risk
- If FABQ_WK is Null and FABQW_STATUS is LT 29 = Negative
- If FABQ_WK is Null and FABQW_STATUS is Null = UNK

Step 2 – Code BB_PA field

- If FABQ_PA > 14 = Positive
- If FABQ_PA ≤ 14 = Negative
- If FABQ_PA is Null and FABQPA_STATUS is GT 14 = Positive
- If FABQ_PA is Null and FABQPA_STATUS is LTE 14 = Negative
- If FABQ_PA is Null and FABQPA_STATUS is Null = UNK

Step 3 – Code CLINCAL_STAGE field

- If OSWESTRY ≥ 30 = Stage_1
- If OSWESTRY is 20 to 29 = Stage_2
- If OSWESTRY ≤ 19 = Stage_3
- If OSWESTRY NULL = UNK

Step 4 – Code TBC_SUMMARY & TBC_DETAIL – Biobehavioral (BB)

- If BB_WK = Positive then
  - TBC_SUMMARY = BB
  - TBC_DETAIL = BB(+)
- If BB_WK = At Risk then
  - TBC_SUMMARY = BB
  - TBC_DETAIL = BB(AR)
- If BB_WK = Negative and BB_PA = Positive then
  - TBC_SUMMARY = BB
  - TBC_DETAIL = BB(PA)
- If BB_WK = UNK and BB_PA = Positive then
  - TBC_SUMMARY = BB
  - TBC_DETAIL = BB(PA)

Step 5 – Code TBC_SUMMARY & TBC_DETAIL – Stage 2

- If BB_WK = Negative and BB_PA = Negative and CLINCAL_STAGE = Stage_2 then
    - TBC_SUMMARY = S2
    - TBC_DETAIL = S2 (20-29)
- If BB_WK = UNK and BB_PA = Negative and CLINCAL_STAGE = Stage_2 then
    - TBC_SUMMARY = S2
    - TBC_DETAIL = S2 (20-29)
- If BB_WK = Negative and BB_PA = UNK and CLINCAL_STAGE = Stage_2 then
    - TBC_SUMMARY = S2
    - TBC_DETAIL = S2 (20-29)
- If BB_WK = UNK and BB_PA = UNK and CLINCAL_STAGE = Stage_2 then
    - TBC_SUMMARY = S2
    - TBC_DETAIL = S2 (20-29)

Step 6 – Code TBC_SUMMARY & TBC_DETAIL – Stage 3

- If BB_WK = Negative and BB_PA = Negative and CLINCAL_STAGE = Stage_3 then
    - TBC_SUMMARY = S3
    - TBC_DETAIL = S3 (<20)
- If BB_WK = UNK and BB_PA = Negative and CLINCAL_STAGE = Stage_3 then
    - TBC_SUMMARY = S3
    - TBC_DETAIL = S3 <20)
- If BB_WK = Negative and BB_PA = UNK and CLINCAL_STAGE = Stage_3 then
    - TBC_SUMMARY = S3
    - TBC_DETAIL = S3 (<20)
- If BB_WK = UNK and BB_PA = UNK and CLINCAL_STAGE = Stage_3 then
    - TBC_SUMMARY = S3
    - TBC_DETAIL = S3 (<20)

Step 7 – Code TBC_SUMMARY & TBC_DETAIL – Specific Exercise (SE)

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY ≠ BB and LOCATION = 2 and DIRECTIONAL_P = EXTENSION then
    - TBC_SUMMARY = SE
    - TBC_DETAIL = SE-Ext
- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY ≠ BB and LOCATION = 2 and DIRECTIONAL_P = FLEXION then
    - TBC_SUMMARY = SE
    - TBC_DETAIL = SE-Flex

Step 8 – Code TBC_SUMMARY & TBC_DETAIL – Manual Therapy (SMT)

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY ≠ BB and LOCATION = 0 or LOCATION = 1 and DURATION = LTE15 and DIRECTIONAL_P = NONE or DIRECTIONAL_P = NULL then
    - TBC_SUMMARY = SMT
    - TBC_DETAIL = SMT

Step 9 – Code TBC_SUMMARY & TBC_DETAIL – Traction (Traction)

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY ≠ BB and LOCATION = 2 and DIRECTIONAL_P = NONE then
    - TBC_SUMMARY = Traction
    - TBC_DETAIL = Traction

Step 10 – Code TBC_SUMMARY & TBC_DETAIL – Stabilization (STAB)

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and AGE < 40 and ABERRANT_M = 1 and PRONE_IT = POSITIVE then
    - TBC_SUMMARY = STAB
    - TBC_DETAIL = Age-AM-PI
- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and AGE < 40 and ABERRANT_M = 1 and AVGSLR = GTE 91 then
    - TBC_SUMMARY = STAB
    - TBC_DETAIL = Age-AM-SLR
- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and AGE < 40 and AVGSLR = GTE 91 and PRONE_IT = POSITIVE then
    - TBC_SUMMARY = STAB
    - TBC_DETAIL = Age-SLR-PI
- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and ABERRANT_M = 1 and AVGSLR = GTE 91 and PRONE_IT = POSITIVE then
    - TBC_SUMMARY = STAB
    - TBC_DETAIL = AM-SLR-PI
- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and PRONE_IT = POSITIVE then
    - TBC_SUMMARY = STAB
    - TBC_DETAIL = PI

Step 11 – Code TBC_SUMMARY & TBC_DETAIL – Specific Exercise (SE) Modification 1

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and LOCATION = 1 and DIRECTIONAL_P = EXTENSION then
    - TBC_SUMMARY = SE
    - TBC_DETAIL = SE-Ext-Loc1

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and LOCATION = 1 and DIRECTIONAL_P = FLEXION then
    - TBC_SUMMARY = SE
    - TBC_DETAIL = SE-Flex-Loc1

Step 12 – Code TBC_SUMMARY & TBC_DETAIL – Manual Therapy (SMT) Modification 1

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and MOBILITY_T = HYPO then
    - TBC_SUMMARY = SMT
    - TBC_DETAIL = SMT-Hypo

Step 13 – Code TBC_SUMMARY & TBC_DETAIL – Stabilization (STAB) Modification 1

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and FREQUENCY_INCREASING = 1 then
    - TBC_SUMMARY = STAB
    - TBC_DETAIL = FreqInc

Step 14 – Code TBC_SUMMARY & TBC_DETAIL – Specific Exercise (SE) Modification 2

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and LOCATION = 0 and DIRECTIONAL_P = EXTENSION then
    - TBC_SUMMARY = SE
    - TBC_DETAIL = SE-Ext-Loc0
- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and LOCATION = 0 and DIRECTIONAL_P = FLEXION then
    - TBC_SUMMARY = SE
    - TBC_DETAIL = SE-Flex-Loc0

Step 15 – Code TBC_SUMMARY & TBC_DETAIL – Stabilization (STAB) Modification 2

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and MOBILITY_T = HYPER and DURATION = GT 15 then
    - TBC_SUMMARY = STAB
    - TBC_DETAIL = Hyper-GT15

Step 16 – Code TBC_SUMMARY & TBC_DETAIL – Stabilization (STAB) Modification 3

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and PREVIOUS_LBP = GT5 then

- TBC_SUMMARY = STAB
- TBC_DETAIL = Prev-GT5

Step 17 – Code TBC_SUMMARY & TBC_DETAIL – Stabilization (STAB) Modification 4

- If CLINCAL_STAGE = Stage_1 and TBC_SUMMARY = NULL and DURATION = GT 15 then
  - TBC_SUMMARY = STAB
  - TBC_DETAIL = Dur-GT15

Step 18 – Code TBC_SUMMARY & TBC_DETAIL – Unclassifiable

- If CLINCAL_STAGE = UNK then
  - TBC_SUMMARY = NULL

TBC_DETAIL = NULL

APPENDIX K

SEMI-STRUCTURED INTERVIEW GUIDES

Capturing the Therapist's Perspective of the CRS Low Back Quality Initiative –

High Performer Interview Guide

INTRODUCTION

Hello, I am calling regarding the project on the Low Back Initiative. Is this still a good time to conduct the interview? Great! Thank you for taking the time to speak with me today. Before we begin, I would like to remind you that the goal of this project is to gain therapists' perspective of the Low Back Quality Initiative which includes the treatment based classification. The purpose of our call today is to capture your insights on managing low back pain patients within the context of Low Back Quality Initiative including the use of the treatment based classification.

Any information you provide will be kept strictly confidential as I will be the only one to view and maintain your contact information. Our discussion will be audio recorded to help me accurately capture your thoughts in your own words, but these recordings will only be heard by members of the research team. Finally, direct quotes from you may be used in reports of the project, but your name and other identifying information will be kept anonymous. Are you ready to get started?

QUESTIONS FOR HIGH PERFORMING PROVIDERS

1. Roughly speaking what percentage of your patients have a primary complaint of low back pain?
2. Briefly, how do you use the treatment based classification in the management of patients with low back pain?
3. What aspects or components of the treatment based classification do you find helpful in your decision making process?
    a. Probe 1 – How do you screen for red flags (pain is not coming from muscles/ligaments in back, but from vascular system, GI tract, or another emergent condition)? Do you screen ALL patients for red flags, or just SOME of them?
        A. If SOME – How do you decide whether or not to screen a patient for red flags?
    b. Probe 2 – How do you screen for fear avoidance behaviors or psychosocial distress? Do you screen ALL patients for fear avoidance behaviors, or just SOME of them?
        B. If SOME – How do you decide whether or not to screen a patient for fear avoidance behaviors?
    c. Probe 3 – How do you stage (classify the severity of the patient's condition) patients? Do you stage ALL patients, or just SOME of them?
        If SOME – How do you decide whether or not to stage a patient?
    d. Probe 4 – How do you select your treatments for each patient?
4. What aspects or components of the treatment based classification are not helpful in your decision making process?

    a. Probe 1 – In these areas do use a different strategy to aid decision making?
    b. Probe 2 – Does this [component(s)] miss an important clinical cue?
    c. Probe 3 – Does this [component(s)] not improve outcomes for your patients?
5. How do you manage patients who demonstrate high fear avoidance behaviors?
    a. Probe 1 – Communication strategies
    b. Probe 2 – Educational messaging
    c. Probe 3 – Hands-on treatment and exercise
6. How confident are you in managing patients with low back pain?
    a. Probe 1 – What has contributed to your level of confidence?
    b. Probe 2 – How has your approach changed over time?
7. How much importance do you place on the use of the treatment based classification?
    a. Probe 1 – Considering discussions around the treatment based classification, how much importance would you say that your colleagues place on using it?
    b. Probe 2 – Thinking about discussions with your immediate supervisor about the treatment based classification, how much importance would you say that your supervisor places on using it?
    c. Probe 3 – In light of communications from the organizational leadership (CRS executives), how much importance would you say that they place on using the treatment based classification?

Capturing the Therapist's Perspective of the CRS Low Back Quality Initiative –

High Performer Interview Guide

INTRODUCTION

Hello, I am calling regarding the project on the Low Back Initiative. Is this still a good time to conduct the interview? Great! Thank you for taking the time to speak with me today. Before we begin, I would like to remind you that the goal of this project is to gain therapists' perspective of the Low Back Quality Initiative which includes the treatment based classification. The purpose of our call today is to capture your insights on managing low back pain patients within the context of Low Back Quality Initiative including the use of the treatment based classification.

Any information you provide will be kept strictly confidential as I will be the only individual to view and maintain your contact information. Our discussion will be audio recorded to help me accurately capture your thoughts in your own words, but these recordings will only be heard by members of the research team. Finally, direct quotes from you may be used in reports of the project, but your name and other identifying information will be kept anonymous. Are you ready to get started?

QUESTIONS FOR LOW PERFORMING PROVIDERS

1. Roughly speaking what percentage of your patients have a primary complaint of low back pain?
2. Are you familiar with the treatment based classification?
    A. If NO – The treatment based classification is an approach to management of low back pain that uses three levels of clinical decision making. The first level involves screening patients for eligibility to receive physical therapy, the second level entails staging patients according to the severity of symptoms and the third level is selecting treatment based on the expected probability of success. The treatment based classification id the center piece of CRS' Low Back Quality Initiative.
        a. Probe 1 - Are you familiar with the broader Low Back Quality Initiative?
    B. If YES - How often do you use the treatment based classification in your practice?
        a. Probe 1 – Why don't you use it more often?
        b. Probe 2 – How could it be improved to make it more likely you would use it?
3. Tell me about your approach to assessing a patient with low back pain.
    a. Probe 1 – Are there clinical cues you tend to look for?
    b. Probe 2 – Are there particular tests or measures that you find valuable?
    c. Probe 3 – How do you screen for fear avoidance behaviors or psychosocial distress?
        - Probe 3.1 – (*If not mentioned*) In what ways do you use the STarT Back scores to alter or guide your approach to patients?
4. Tell me how you develop your physical therapy diagnosis or diagnoses given your findings during the assessment.
    a. Probe 1 – do you base it on symptoms
    b. Probe 2 – do you base it on impairments

    c. Probe 3 – do you base it on functional limitations or deficits
5. Describe how you select your interventions. (determine what you need to do given your assessment and diagnosis)
    a. Probe 1 – Are there specific interventions that you find particularly useful?
    b. Probe 2 – (*If not mentioned*) What are the specific criteria that you use when choosing these interventions?
    c. Probe 3 – How do you evaluate the effectiveness of these interventions?
    d. Probe 4 – Are there specific interventions that you prefer **not** to use and why?
        i. Biobehavioral education (for patients that score high on the FABQ or STarT Back)
        ii. Graded or quota based exercises (*If prefer to use*) When do you choose to use this intervention? (*And/Or)* What criteria do patients meet for you to use this intervention?
        iii. Directional preference exercises (*If prefer to use*) When do you choose to use this intervention? (*And/Or)* What criteria do patients meet for you to use this intervention?
        iv. Manipulation / mobilization (*If prefer to use*) When do you choose to use this intervention? (*And/Or)* What criteria do patients meet for you to use this intervention?
        v. Traction (*If prefer to use*) When do you choose to use this intervention? (*And/Or)* What criteria do patients meet for you to use this intervention?
    e. How would you rate your confidence in managing patients with Low back pain?
        i. Probe 1 – What has contributed to your level of confidence?
        ii. Probe 2 – How has your approach changed over time?
6. How much importance do you place on the use of the treatment based classification?
    a. Probe 1 – Considering discussions around the treatment based classification, how much importance would you say that your colleagues place on using it?
    b. Probe 2 – Thinking about discussions with your immediate supervisor about the treatment based classification, how much importance would you say that your supervisor places on using it?

Probe 3 – In light of communications from the organizational leadership (CRS executives), how much importance would you say that they place on using the treatment based classification?

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